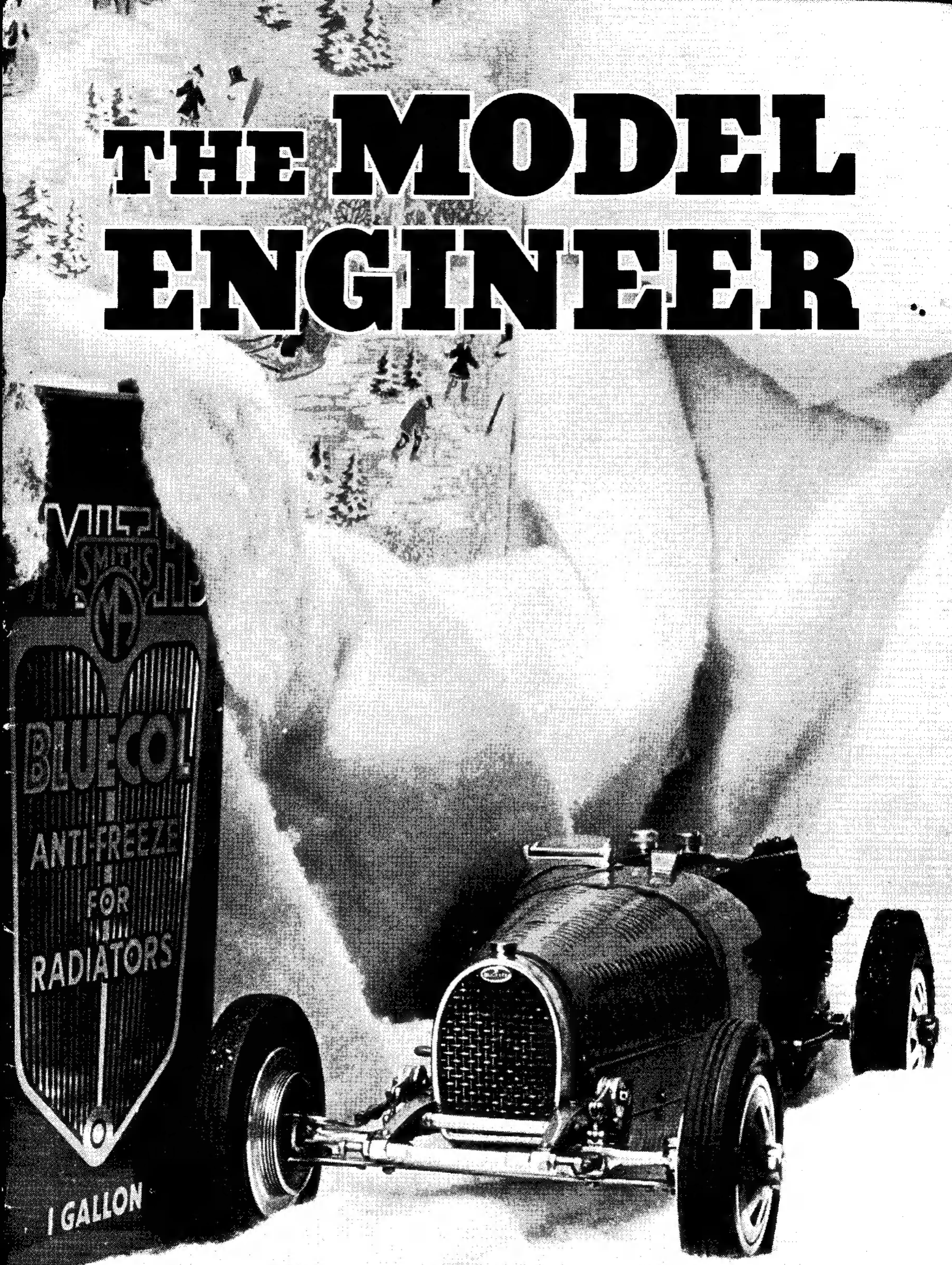
THE MODEL ENGINEER



Vol. 104 No. 2591 THURSDAY JAN 18 1951 9d.

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD. 23, GREAT QUEEN ST., LONDON, W.C.2

18TH JANUARY 1951 — VOL. 104 — NO. 2591

SMOKE RINGS

Our Cover Picture

● ONE OF the finest examples of miniature motor engineering, Mr. W. P. Jones's " Bugatti," poses for the camera in a scene which amply depicts the winter spirit.

For the benefit of those of our readers who are not yet *au fait* with this model, it will be of interest to note that there is very little missing in outside detail. The steering wheel, not visible in this view, is connected *via* the correct linkage and actually works, as do the front suspension and shock absorbers.

Craftsmanship

● THE *Sunday Times* recently published a letter referring to the alleged decline of craftsmanship, and in view of comments which we have made on this subject, from time to time, we were naturally interested to read it, especially the following sentences: " Forty-five years ago, as a works manager, I had no difficulty in engaging highly skilled fitters, turners and machinists who could be relied upon for first-class work. Thirty-three years ago, with authority to comb industry for such men, I had great difficulty in securing the services of twenty individuals. Within the past twelve years, I have found that, despite advanced age, the only way to get some jobs done was to do them myself.

" Not long ago, a fine tradesman of the old school told me to go to the *Amateur* Model Makers' Exhibition if I wanted to see fine examples of handicraft still being provided."

We are not so concerned with the reasons for the unfortunate experiences related in the first paragraph of that letter; we agree that there *are* reasons, and they are due to ever-changing conditions with the passing of time. We know that many people feel that those changes are not altogether advantageous and are not stimulating an interest in craftsmanship of any kind.

However, we have always maintained that craftsmanship is not dead; how, when and where it reveals itself today depends upon the encouragement given to potential craftsmen, in the form of instruction or guidance. It is here that THE MODEL ENGINEER comes into the picture, and the last paragraph of the above-quoted letter points directly to the result. The operative word is the italicised one, and we think there is nothing more to add.

Accident to Beam Engine

● A 77-YEAR-OLD beam engine, working at a tin mine at Pool, Cornwall, recently met with a serious accident which will probably result in the engine being dismantled and scrapped. It was working quite normally when, without the slightest warning, the beam, or " bob " as it is called, broke right through and fell to the ground. Part of it narrowly missed hitting the engineman on duty.

This engine was employed, as usual, in pumping water out of the mine workings, and the immediate result of the accident was that serious flooding was threatened. Electrical pumps, installed some time ago as a standby, were promptly put into action, but, unfortunately, the flow of water has, so far, shown a persistent tendency to gain on the pumps, and the future of the mine would seem to be in jeopardy.

Accidents of this nature have been rare in the long history of Cornish pumps, and this recent mishap is therefore all the more regrettable. We can only hope that the loss of the sturdy old pump will not lead to the eventual closing of the mine.

Double-deck Trains a Disadvantage

● DURING THE past twelve months, the Railway Executive has been carrying out intensive trials, under varied traffic conditions, of the experimental double-deck passenger train which was introduced on the Eastern Section electrified lines of the Southern Region as a possible alternative to longer trains for the purpose of reducing peak-hour congestion. The conclusion reached from these trials, and concurred in by the British Transport Commission, is that the double-deck train does not offer a satisfactory long-term solution of the problem, and that both public interest and operating efficiency will be better served by running longer trains (10 cars instead of 8) of normal type, but of modern commodious design, and lengthening platforms where necessary to accommodate them.

The seating capacity of the experimental 8-car double-deck train is 1,016 passengers, compared with 772 in an ordinary 8-car train, and 945 in the 10-car trains of new design (including coaches with centre corridors.)

The trials have revealed, however, that this advantage of extra seating capacity is more than outweighed by slower working in passenger stations owing to the longer time required for passengers to entrain and detrain, as the double-decker train affords one door per 22 seats compared with 10 or 12 in ordinary compartment stock. In addition, the double-deck coaching stock suffers from physical disadvantages such as less cubic capacity per passenger, and smaller and less comfortable seats; owing to the necessarily small clearances within bridges, tunnels, etc., it is difficult within the limits of the loading gauge to provide adequate ventilation to the upper deck; because of its dimensions, double-deck coaching stock can be used only on a limited number of sections of the Southern Region electrified system. This restricts its availability for relieving on other sections of the system (e.g. Chatham line) at holiday times, thus lowering the overall availability of coaching stock.

After full consideration of the results of the double-deck experiment, and while recognising the ingenuity of its design and construction, the Railway Executive has, therefore, reached the conclusion that as a long-term policy " double-decking " is not the most satisfactory answer to peak-hour congestion, with regard both to comfort and convenience of the travelling public and to efficiency of operation.

Plans are accordingly being pressed forward for the provision of 10-car trains for peak-hour service on certain of the busiest Southern Region (Eastern Section) suburban routes. In conjunction with the introduction of these trains (which will require the construction of 66 new 2-car sets as well as the modernisation of 132 four-car trains), lengthening of platforms at many suburban stations and other extensive engineering work will be required, including major alterations at Cannon Street station. It will be appreciated that under present conditions, the provision of the necessary rolling stock, the civil engineering works, and the equipment for the additional electrical supply required for longer trains, will take a considerable time, but every effort will be made to implement the scheme as quickly as possible and introduce it in stages.

Sheer Selfishness

● WE WERE rather shocked, not long since, to receive a letter asking if we could give a complete list of dimensions for a locomotive which, as our querist put it, " is seen in the photograph reproduced in the enclosed cutting." We were able to oblige, as it happened; but what shocked us was that the said " cutting " was a page which had obviously been *torn* out of a well-known book on locomotives.

We are not suggesting that our querist had torn the page out; he may not have done. Unfortunately, however, we know that such mutilation of useful reference books, especially in public libraries is all too common, and we suggest that it is an act of vandalism which cannot be inspired by any other motive than sheer selfishness. It is a very short-sighted action which deserves the strongest condemnation; whoever does it can have no sense of values, quite apart from the intrinsic infamy of the act.

The results of tearing pages out of reference books are not difficult to foresee, surely; the two principal ones are: the inconvenience caused to other people, who discover that the information they want is missing, and the fact that the mutilated book is worthless. The vandals can have no sense of the fitness of things, and we find the question as to what is a suitable retribution a very difficult one to decide!

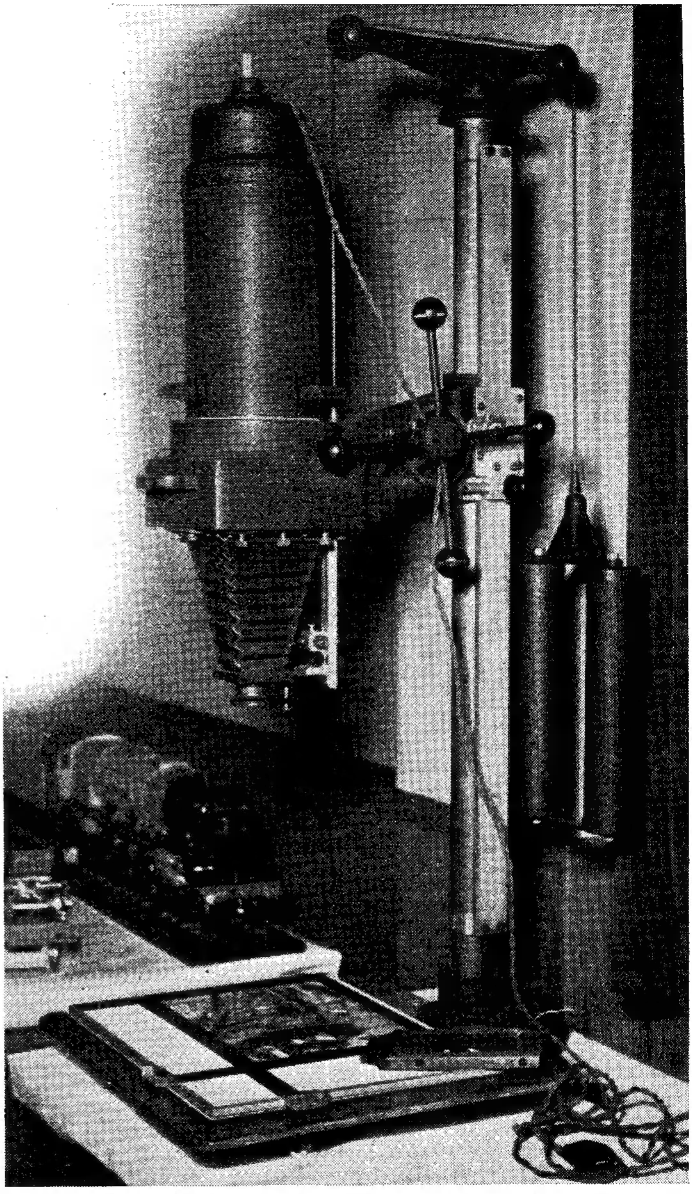
Mr. David C. Curwen

● WE LEARN that Mr. Curwen has severed his connection with David Curwen Ltd., of Baydon, and is now operating on his own. During the past few years, he has become well known in the model and experimental engineering field, especially where steam locomotives and steam engines of all kinds are concerned. We are sure that his many friends will be glad to learn that his services are still available to them at his new address: Oxford Street, Ramsbury, Wilts.

My Enlarger

by

Richard M. Cookson



Mr. Cookson's enlarger on exhibition at Preston

I WAS first attracted to photography by the desire to record in pictures the passing of the square-rigged sailing vessel. In the years that followed I eventually acquired a library of unique negatives and so was born the desire to see my efforts enlarged to a uniform whole-plate size. To achieve this I decided to design and build my own enlarger.

The apparatus on the market within my limted financial resources seemed to be lacking in the one essential—rigidity. This latter is the keynote of the design here presented.

A cast-iron base, triangular in plan, and supported on three adjustable feet, supports a 2 in. steel tubular column. The slide casting (in aluminium) is bored a good sliding fit for the column and travels up and down by means of the rack and geared pinion, in much the same way as some pillar drill tables are operated. This assembly and column can be readily swung right round for projection on to the floor, if such capacity is called for. Such movement takes place by turning the column round in the boss marked *A* in the general arrangement drawing. Locking is provided for by means of the Allen grub-screw pressing on a brass plug. (See drawing of column base.)

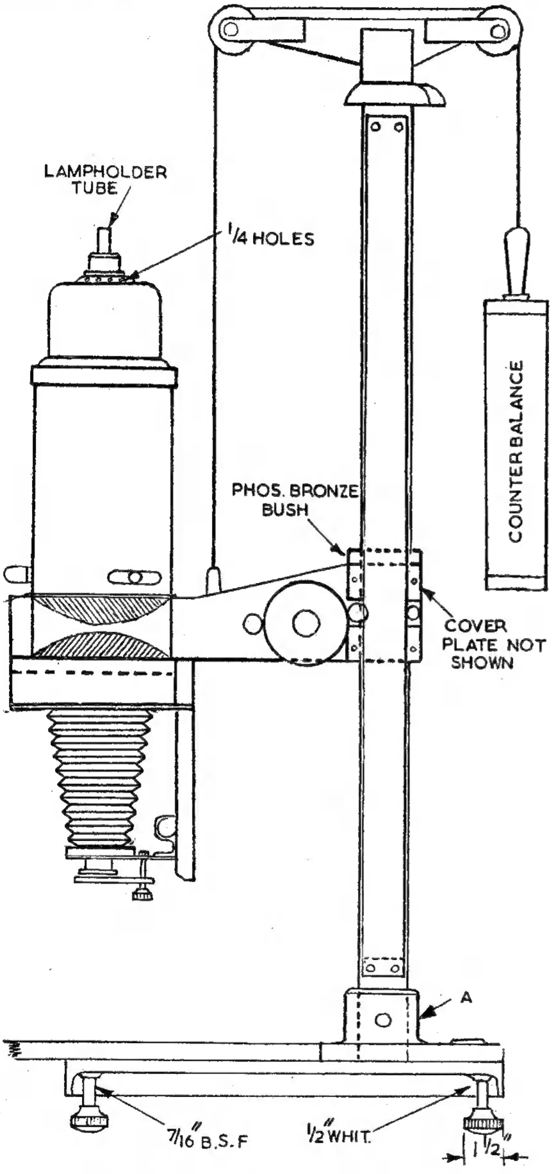
Ventilation of the lamp-house is achieved in rather a novel manner. Three light-tight vents admit cool air at the bottom of the light chamber, and a series of ½ in. diameter holes at the top of the casing provide exit for the heated air, a very efficient circulation being maintained. The lamp-house is a push-fit on to the raised rim of the condenser and served originally as the dust-chamber of a vacuum-cleaner. A baffle-plate is fitted inside the top just under the vent hole to prevent light leakage.

A bush was made to fit the usual hole in the end casing of these cleaner bodies and this carries the tube of the lamp-holder which is adjustable over a range of approximately 3 in.

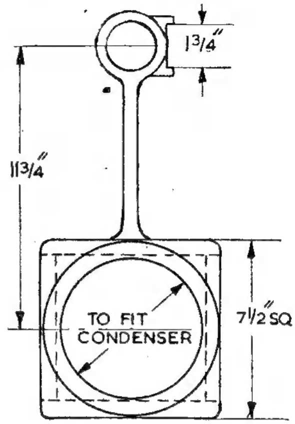
Lighting is by means of a Siemens' P.E. 150 lamp, but a more satisfactory lamp would be a flashed opal, which, I understand, is no longer made. The white coating of the Siemens lamp flakes off unless looked after extremely well. The 5½ in. D.P. convex condenser is an easy

fit in the housing provided in the slide casting, and can be readily cleaned by simply removing the lamp-house. Negative slides are accommodated in the box form immediately under the condenser. This is simply built up from 2 in. wide dural and bolted to the underside of the

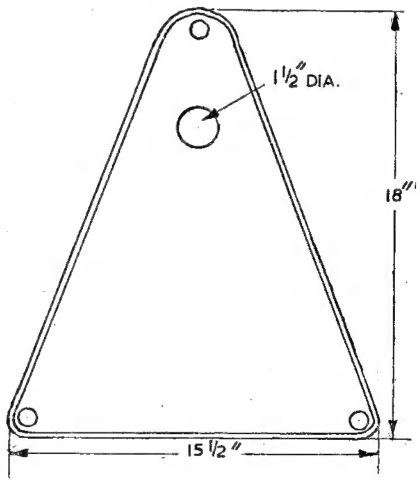
old Sanderson camera, and are quickly detached from the perspex panel by means of special clips. The lens is a Zeiss Tessar f. 4.5 × 12 cm. focal length and is contained in an adjustable mount, permitting a fine adjustment over approximately ½ in. Final focussing is achieved



Side elevation of enlarger, showing geared side



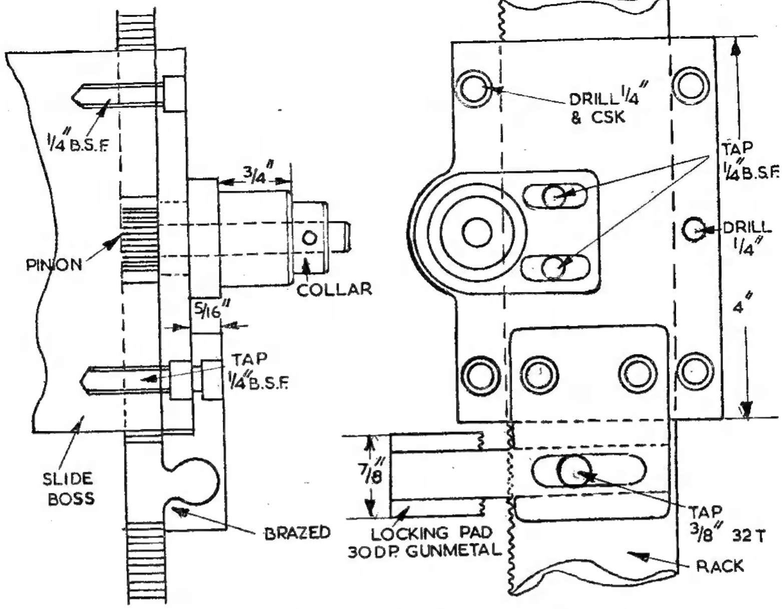
Details of column slide (aluminium)



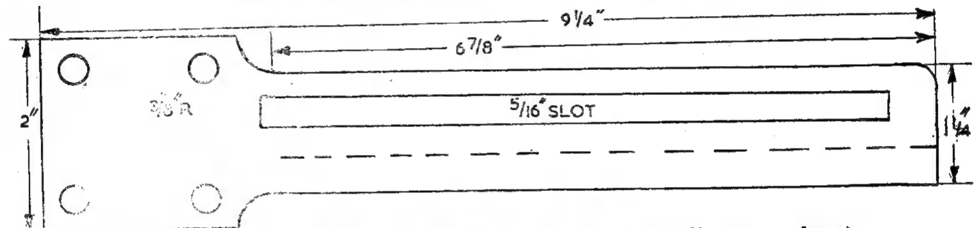
View of base (underside) cast-iron

slide casting at the corners by means of Allen cap-head screws. A panel to carry the bellows is attached to the bottom of this box and is made from black perspex, dulled with fine glasspaper. Bellows are second-hand, gleaned from a very

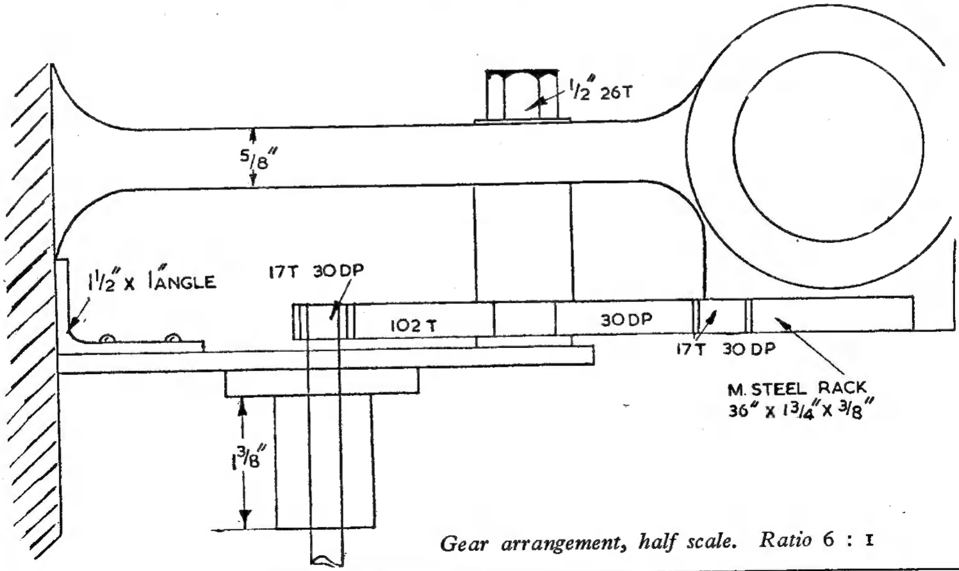
by this convenient facility. The whole weight of the enlarging head is counter-balanced, and movement up and down the column rack is effortless and smooth. A stop pad is provided to lock the head at any of the required positions



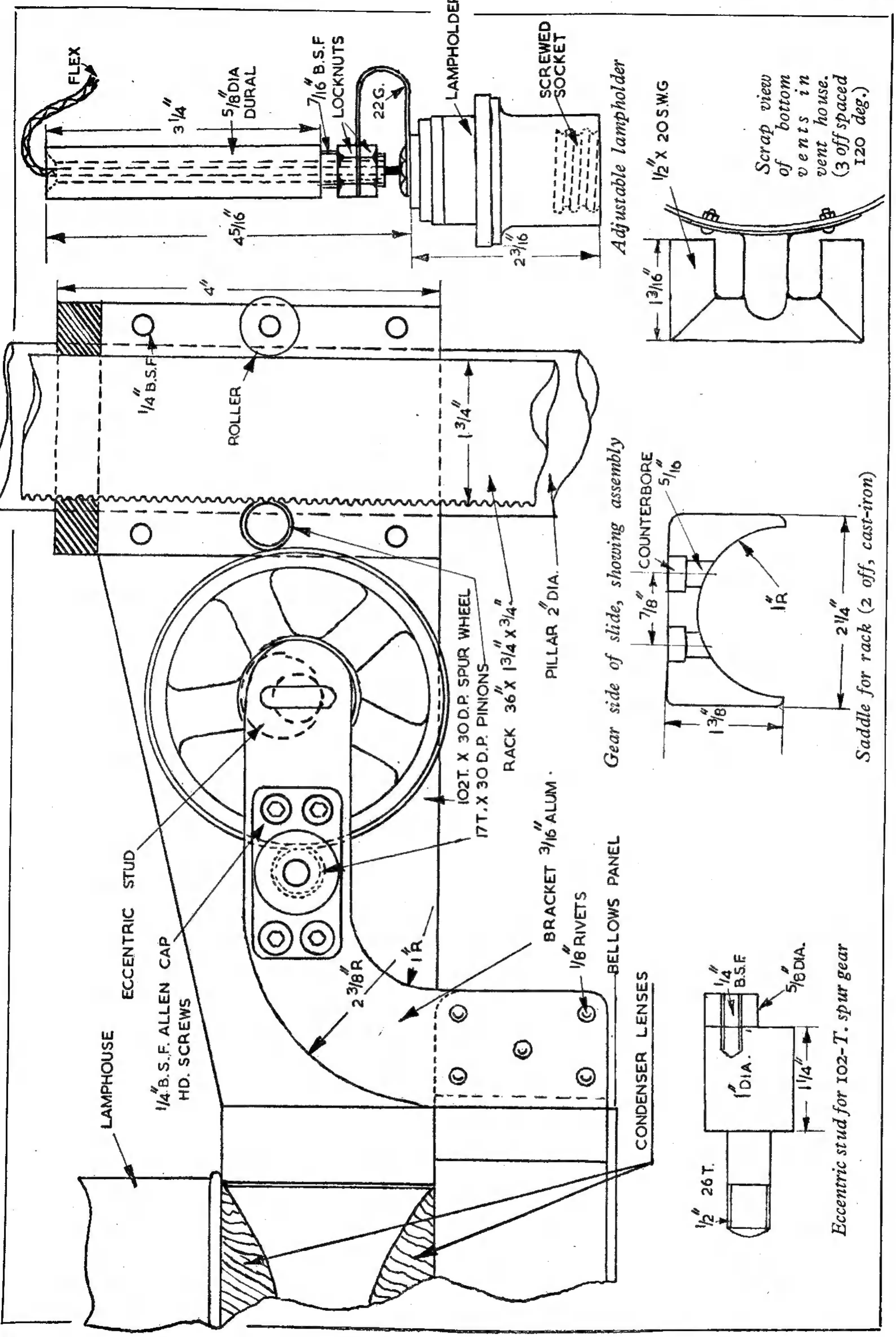
Details of sideplate on slide. Use Allen cap-head screws



Bellows rack. Plan of baseplate. (1 *off* 10-*s.w.g. brass*)



Gear arrangement, half scale. Ratio 6 : 1



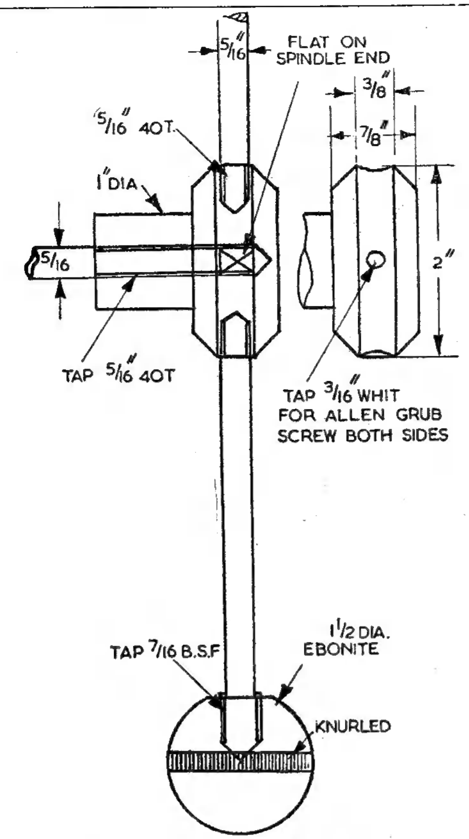
Adjustable lampholder

Scrap view of bottom vents in vent house. (3 off spaced 120 deg.)

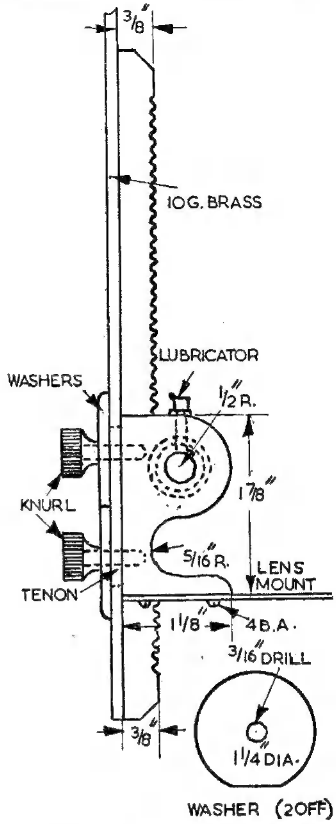
Gear side of slide, showing assembly

Saddle for rack (2 off, cast-iron)

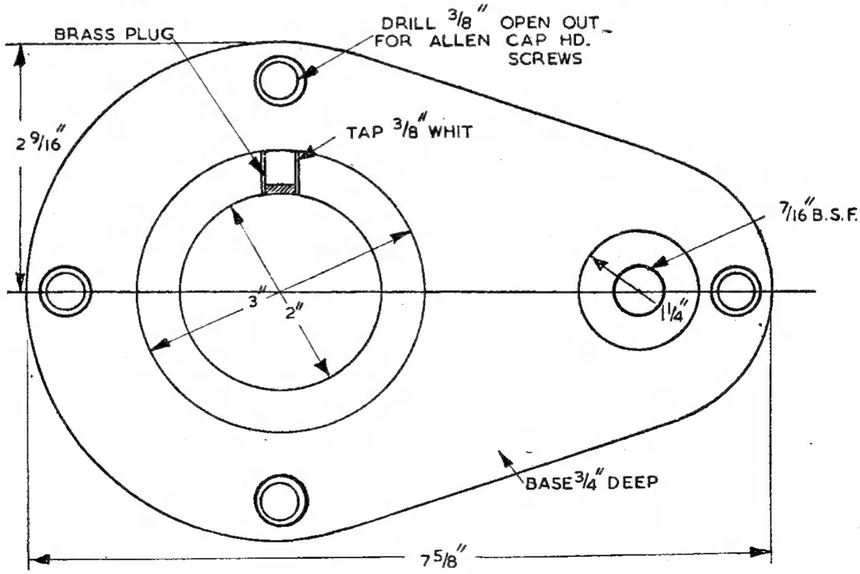
Eccentric stud for 102-T. spur gear



Section of four-ball handle



Rack gear (for extending bellows)

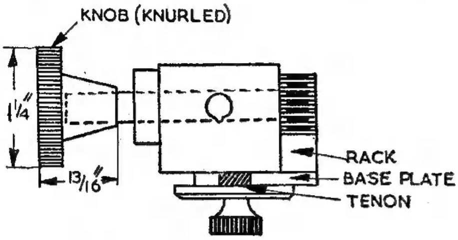


Column base

of magnification. This is a simple device and can be readily understood from the drawing of "Detail of Side Plate."

The Spur Gear

The exact location of the stud to carry this was rather difficult to arrive at, so the idea of an eccentric stud was evolved and proved to be very

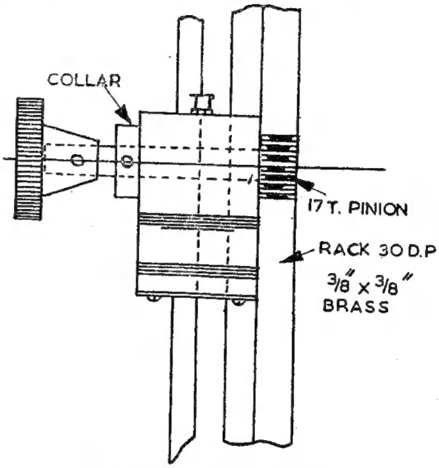


End elevation of bellows rack

effective. Once locked in position, the whole train of gears was simple to locate, since the pinion working on the rack is also adjustable in the slots provided in the bracket, and the driving pinion is fitted last of all. The ratio is 6-1, and, with the fine pitch (30 d.p.) gears, a very satisfactory movement is the result. Both racks were cut by Messrs. Eagle Milling Co. Ltd. (advertisers in "M.E." columns), and are a first-class job (usual disclaimer). Counter-balance consists of two brass tubes loaded with steel washers to the correct degree required, and the connecting cable is simply a length of roller cable of the type sometimes used in the movement of motor-car windows; it is very light, flexible and strong.

Overhead pulleys are arranged on the top cap of the column, the whole assembly being made of dural. Negatives are carried in glassless carriers and are entered from the front. This can be a disadvantage where a length of film is required to be printed, but in the writer's case this does not arise. Alternative entry from the side can, however, be quite easily arranged. A masking frame, capacity up to 16 in. × 12 in., is placed on a ½-in. plywood panel, measuring 20 in. × 18 in., which is screwed to the triangular base casting, a section being cut out at the back to surround the column base.

The whole of the machining, except the large base and slide casting, was done on a Myford M.L.7 lathe. Patterns were made for the two base castings, the slide, and the top cap for the column, and the writer will be pleased to loan these to any enthusiast who fancies the design of this job. Indeed, any queries received with regard to any part of the enlarger will be welcomed.



Plan of bellows rack

The finish throughout is black crackle stove enamel, and *dull* nickel plating. Bright chrome finish is not recommended on photographic apparatus. The reproduced photograph shows the enlarger exhibited at the Preston Society of Model Engineers show last August.

For the Bookshelf

British Locomotives from the Footplate, by O. S. Nock. (London: Ian Allan Ltd.) 244 pages, size 5½ in. by 8½ in. Illustrated. Price 17s. 6d. net.

We believe that Mr. O. S. Nock must easily qualify for the title: England's Most Prolific Author of Railway Books! Yet most of his work is different from that of other writers on similar subjects, in that he writes almost entirely from personal observation and experience. This new book is made up of a series of accounts of journeys made on the footplates of British locomotives since 1945, though one or two pre-war trips have been inserted for the sake of direct comparison, where desirable.

An extraordinary variety of locomotives are involved in these accounts, and include even those hearty, if venerable stalwarts, the Churchward "Saints" of the Western Region. That these old engines should still be capable of work like that so carefully described here by Mr. Nock is a telling tribute to the soundness of the design and the astonishing far-sightedness of the designer.

The value of these accounts, to all who make a study of locomotive engineering, is greatly enhanced by the particulars of such information as boiler pressure, point of cut-off, consumption of fuel and water, speed and gradient, not to forget the load hauled; it all helps the reader to appreciate the qualities of the locomotive under notice and leaves little room for guesswork or wishful thinking. Each journey has its own features of interest, all duly noted by the author; which means that the book is, at once, interesting, enjoyable and instructive. The illustrations are all new and excellent.

*A $\frac{3}{4}$-in. x $\frac{3}{4}$-in. Vertical Steam Engine

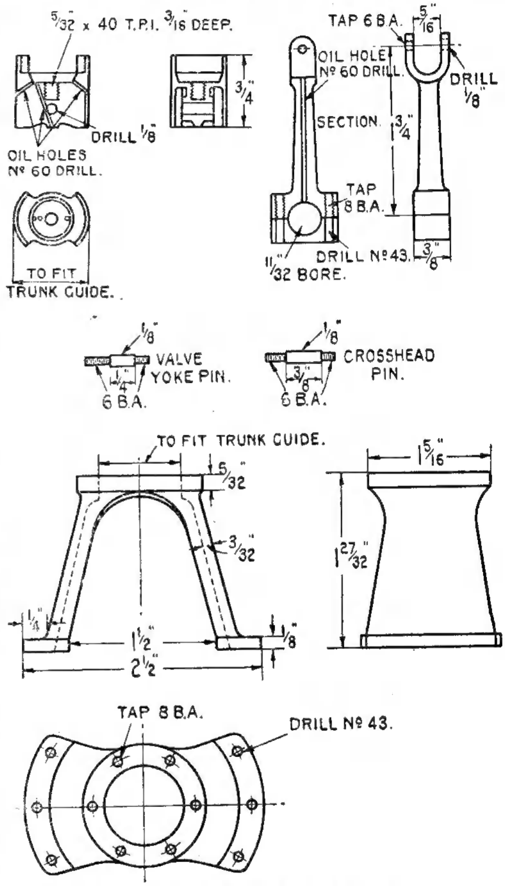
by H. W. R. Gosden

THE crosshead is held by the chucking piece provided, turned to fit the trunk guide, the recess in the top machined to a depth of 9/32 in. from the top face, centred, drilled $\frac{1}{8}$ in. to a depth of $\frac{3}{16}$ in., and tapped 5/32 in. × 40 t.p.i. The gudgeon pin hole is drilled $\frac{3}{16}$ in. from the top face, and the bosses faced with a pin drill to leave a thickness of $\frac{5}{16}$ in. Alternatively, the crosshead may be mounted by the gudgeon pin hole on a tiny stub mandrel, and the bosses faced in the lathe.

It will be found convenient to drill the oil holes before cutting off the chucking piece, as this may be held in a machine vice whilst the No. 60 holes are drilled. The two holes feeding the crosshead slides are a very simple job, but the third hole is a little tricky, as it breaks into the side of the gudgeon pin hole, and finishes approximately in the centre of the bottom of the crosshead. Held in the machine vice, the angle can be adjusted until the drill can be "sighted" to take the right line. Push a piece of $\frac{1}{8}$ in. aluminium or brass rod into the gudgeon pin hole whilst drilling this oil hole—and reduce the mortality among No. 60 drills.

The crosshead is then held in a suitable thin or split bush with the chucking piece outwards. This is parted off, and a blunt cone turned to lead oil to the centre (if the oil hole is not dead true) and form a "drip-point" for lubrication of the big end through the hollow connecting-rod, which is the next part to machine.

The connecting-rod casting is provided with a chucking-piece at each end, and machining commences by holding the small end chucking-piece in the chuck, and facing the bottom of the big-end, after which the big-end bolt holes are drilled and tapped 8 B.A., the holes enlarged to No. 43 for half depth, the big end sawn through and a light facing cut taken over the end of the rod and the cap. The chucking-piece on the cap is turned off, and the cap fitted to the rod with two 8-B.A. screws. The rod is machined all over whilst held by the small-end chucking-piece, then the cap is removed without disturbing the rod, the end centred and drilled up about $1\frac{9}{16}$ in. with a No. 60 drill. The big-end is then drilled on the joint line between the cap and rod, starting with a small pilot drill, say $\frac{1}{8}$ in. and enlarging it by easy stages to 11/32 in. This must be done carefully, as the strength of two 8-B.A. screws is not unlimited! The gudgeon-pin hole is drilled in the small-end with a No. 43 drill, enlarged half thickness to $\frac{1}{8}$ in., and tapped 6 B.A. The small-end fork is formed by drilling a $\frac{1}{8}$ in. pilot hole, enlarging to $\frac{5}{16}$ in., cutting off the chucking-piece, sawing down to meet the $\frac{5}{16}$ in. hole, and cleaning up with a file. The ends of the fork are radiused with a file to conform to the gudgeon pin hole. The gudgeon (or crosshead) pin is simply a piece of $\frac{1}{8}$ in. silver-steel, reduced at each end and threaded 6 B.A. A nut is screwed tightly on to one end, and the projecting thread filed flush with the nut. When the pin is assembled a lock-nut is fitted to the threaded end projecting from the small-end fork. To provide a seating for this nut and for the "head" of the crosshead pin, a small flat is filed on each side of the small-end fork.

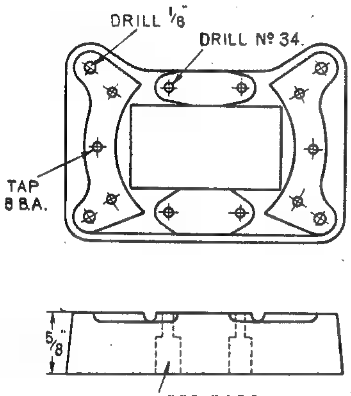


Machine the trunk guide support, or main standard, next. This is an aluminium casting in the form of a truncated cone, with a good solid chucking-piece at the small end (the top). This makes for ease in machining, as the top-slide can be set over to the appropriate angle for machining the outside, the inside bored at the same setting to give a wall thickness of about 3/32 in. except at the top, where it will be bored to fit the spigot on the lower end of the trunk guide—another case of working to calipers. When the bottom flange has been turned to size,

*Continued from page 46, "M.E." January 11, 1951.

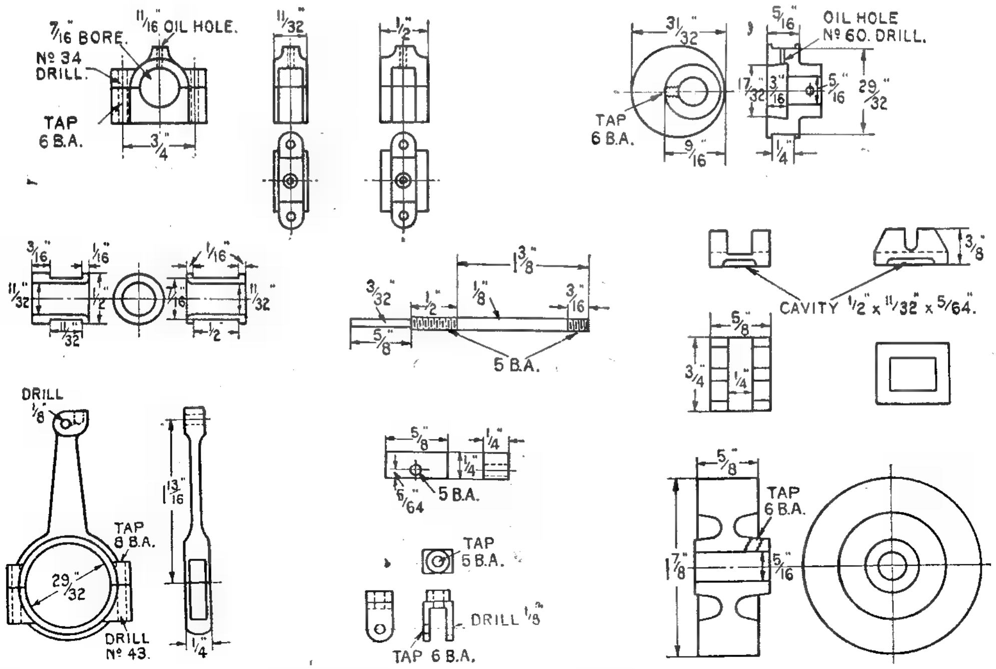
and faced [redacted] both sides, the top flange can be turned and the standard parted off to a length of 1 27/32 in. Mark off and drill the six No. 43 holes in the lower flange. To drill the six No. 8 B.A. tapping holes in the top flange a jig will be required and with a little "wangling" the same jig [redacted] be used for cylinder covers and trunk guide.

It will simplify making the jig if you can find [redacted] steel washer about $1\frac{3}{8}$ in. (or more) in diameter, at least $\frac{1}{16}$ in. thick, and having [redacted] hole less than $\frac{3}{4}$ in. bore. File a nick in the edge, so that the washer can be removed from and replaced in the chuck without loss of truth. Bore the hole to a neat fit for the spigots of the cylinder covers,



take [redacted] very light skim over the face, and make [redacted] light scratch with a V-tool at 1 3/32 in. diameter. Divide this circle into six, using any indexing method that will give reasonable accuracy, arranging it so that one of the divisions is in line with the nick in the edge of the washer. Now remove from the chuck, and drill six No. 50 holes on the marks. Clamp the jig to each cylinder cover in turn and run a No. 50 drill through the holes, taking care to keep the scribed face of the washer to the top of the engine in each case—this applies to all drilling done with this jig. That is to say, for the top cover the jig will be clamped with the scribed face against the cover; for the bottom cover, clamped with the unscribed face to the cover. This will take care of any slight inaccuracy in indexing the six holes. Whilst each cover is clamped to the jig, make a mark on the edge to correspond with the nick in the edge of the jig. After removing the jig, enlarge the holes in the covers with [redacted] No. 43 drill.

Replace the jig in the chuck and bore out to fit the spigot on the lower end of the trunk guide. Clamp the jig in this position—scribed face against the flange—with the nick central to one of the "guide bars" left when the trunk guide was cut to shape. Mark the edge of the flange to correspond with the nick, and drill the holes No. 50, enlarging to No. 43 after removing the jig. Hold [redacted] piece of rod—any metal—about 1 in. in diameter in the chuck, turn down about $\frac{1}{4}$ in. length to fit the cylinder bore, a further $\frac{1}{4}$ in. to fit the hole in the jig, reduce a $\frac{1}{16}$ in. or so to about 31/32 in., and part off. If this is placed in the jig, and the projecting spigot entered into the top of the standard, again with the nick



central to one side, the six No. 50 holes may be drilled in the top face of the standard and tapped 8 B.A. Remember the scribed face is " up " when drilling these holes! Now enter the smaller part of the jig spigot into the top of the trunk guide, and when the shoulder reaches the top face of the guide, press the jig washer down until it presses against the face. Ensure that the nick is dead vertical over the mark on the lower flange, and drill the six No. 50 holes. Remove the jig and enlarge the holes to No. 43. Without altering the jig assembly, drill the cylinder cover screw holes in the top face of the cylinder, bearing in mind that the nick in the jig must always be in the centre of one side, to avoid a " corkscrew " effect on final assembly. The lower face of the cylinder is drilled in the same way, but before doing so reverse the washer on the spigot, so that the scribed face is " upwards." Tap the holes 8 B.A.

All this lengthy description makes this part of the job appear tedious, but in actual fact it is very simple, and it does ensure that everything goes together without trouble.

The standard may now be cut with hacksaw and file to leave a " leg " each side, as shown in the drawings. This calls for a little care in marking out, after which it is a straightforward job—but *don't* grip the standard too tightly in the vice after you have cut off the two " slices." It won't like it!

Machining the bedplate is very simple. Hold it lightly in the 4-jaw chuck with the top outwards and face off with light cuts to get good beds for the main bearings and standard. Reverse in the chuck and face off to a thickness of $\frac{5}{8}$ in. The four $\frac{1}{8}$ in. holding down bolt holes may be marked out and drilled, also the six 8-B.A. tapped holes for the standard. These will be marked out from the standard, but do not drill the main bearing holes until the bearings are made.

The aluminium castings for these are provided with a chucking piece on the lower side, and an oilpipe boss on the top cap. Start work by cleaning up the bolt seats on the top cap with a file, mark the bolt hole centres, grip in a machine vice, and drill through No. 43. Enlarge to No. 34 for a depth of $\frac{1}{4}$ in., and tap the lower part 6 B.A., then saw through to separate the top cap $\frac{1}{4}$ in. below the bolt seats. Held in the chuck by the chucking piece, the sawn face is machined to clean out the saw-marks, and the top cap treated similarly, holding by the oil-pipe boss. This is small, but quite adequate if light cuts are taken. Now fix the cap temporarily with two 6-B.A. screws, inserting a piece of paper between the cap and bearing. Centre-pop on the joint line, drill through $\frac{1}{8}$ in. and enlarge *very carefully* to $\frac{7}{16}$ in., ensuring that the drill is reasonably square with the face. Cut off the chucking piece, mount each bearing in turn on a stub mandrel and face off to the thickness given in the drawings. It is next necessary to face the bottom of each bearing, and I found the most satisfactory way was to fix a $\frac{7}{16}$-in. stub mandrel in an angle-plate bolted to the faceplate and clamp each bearing to it in turn. If the first one is faced to $\frac{3}{8}$ in. from the joint line, the saddle and top-slide left set, and the cross-slide only moved, then the second bearing is fitted to the stub mandrel, the cross-slide fed in, and the two bearings will be of indentical centre height.

The main bearing bushes are turned and bored from phosphor-bronze rod to the dimensions given, and they are *not* split. Before making the bushes it is advisable to machine the crankshaft, so that they may be bored to a really nice fit. The crankshaft is provided with drilled centres, and with the shaft mounted between lathe centres the ends are turned to the given sizes, a very light skim being taken off the face of the webs to clean them up, also the outer periphery. Next, the unwanted piece of crankshaft between the webs is cut away, and the crankshaft gripped in a split bush held in the 4-jaw chuck for machining the crankpin. The correct " offset " can be gauged by inserting a piece of $\frac{1}{4}$ in. rod in the hollow crankpin and adjusting the chuck jaws until the rod spins true when the lathe is turned. Machining the crankpin necessitates using a long narrow tool—I used a parting tool $\frac{1}{8}$ in. wide—and is not a very pleasant task. However, care and patience will produce the desired result. Clean up the inside faces of the webs at the same setting. The idea of leaving the main journals bigger than the ends of the crankshaft is so that they may be re-machined if wear takes place after long service and new bearing bushes made to suit.

Having completed the crankshaft and bearing bushes, they may be assembled in the bearing blocks and lightly clamped to the bedplate. The main bearing temporary screws are then removed one at a time, and a No. 43 drill run down to mark the bedplate. All four holes in the bedplate are then drilled No. 34 to clear 6 B.A. screws which are inserted from underneath and screwed up into the bearing blocks, the ends protruding through the caps to receive the nuts. The holes for the eccentric end bearing screws will need counterdrilling to receive the heads of the 6-B.A. screws, so that they are below the under surface of the bedplate. Assembled thus, the crankshaft should turn quite freely.

The aluminium alloy casting for the slide valve has the cavity formed in it, also the cross slots for the valve spindle and driving nut. If it is held in the 4-jaw chuck, face outwards, and faced off until the cavity is 5/64 in. deep, the cavity will require little, if any, trimming to size. The edges of the valve may be filed to size, being careful to keep the cavity central, also the cross slots.

The valve-rod is made from $\frac{1}{8}$ in. stainless-steel rod, reduced to 3/32 in. at the top end, to the sizes given in the drawing. The brass driving nut should be a good fit on the threaded spindle, and a sliding fit in the valve slot. The 5-B.A. tapped hole in the nut must be as close as possible to the bottom face—if necessary, the nut may be filed until the threads being to show. This is necessary to allow the valve to " float," as there is not much surplus space just here. Make sure the hole is absolutely " square " to the nut. The valve spindle gland is made in the same way as the piston rod gland—to different sizes, of course.

The valve crosshead is made from $\frac{5}{16}$ in. $\times$ $\frac{1}{4}$ in. (or $\frac{5}{16}$ in. square) mild-steel by first drilling the hole for the crosshead pin—drill right

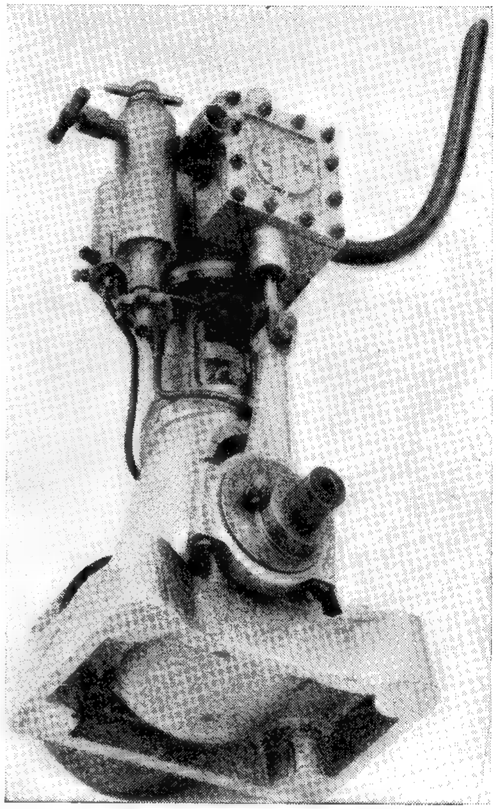
through No. 43, enlarge half way to 1/8 in., and tap remainder 6 B.A.—then cutting the slot with a 3/16 in. milling cutter, or a hacksaw and file. Grip in the 4-jaw chuck, slotted end outwards, centre, drill and tap 5 B.A., turn the little shoulder shown in the drawing, part off, and round the slotted end with a file. Valve crosshead pin is made on similar lines to the piston-rod crosshead pin.

I find it easier to machine the eccentric strap before turning the eccentric, as the latter can then be turned to the exact fit required. In the present case, the aluminium alloy casting for the strap and rod is made oval, so that after splitting and facing it is more nearly circular than is usual. The first job is to face the bolt head seatings lightly with a file, mark and drill the holes No. 50, enlarge half-way with a No. 43, and tap the remainder 6 B.A. Saw the strap in half, and face up both halves with a file, taking care to get a true face, and to keep the halves true to each other. Fit the strap screws, hold lightly in a 3-jaw chuck, and bore out to 29/32 in. Face off the side, reverse in the chuck, and face the other side, being careful to keep the two sides parallel. The finished thickness is 1/4 in. The small end does not really call for any machining, except drilling, as a file will do all that is necessary The finished thickness of the small end is 3/16 in., so if the rod is placed on a flat surface there should be a gap of 1/32 in. at the small end. Turn the rod over to make sure it is symmetrical —if not, a little judicious bending will make it so. Drill the yoke pin hole, the oil well and oil hole, and clean up the rod with a file and emery cloth.

The eccentric is turned from 1 in. diameter mild-steel, held in the 4-jaw chuck. Face the end, turn to 31/32 in. diameter about 3/4 in. long, and turn the groove for the strap, using one half of the strap as a gauge to obtain a good fit. Set over in the chuck 9/64 in., centre and drill through 5/16 in. Enlarge to 17/32 in. to a depth of 3/16 in. and slightly taper the bore inwards, as shown in the drawing. Face the bottom of the counterbore. Leaving a flange 1/32 in. thick, turn down a boss 5/16 in. in diameter and about 3/16 in. long, then part off. Drill the boss No. 43 and tap 6 B.A. for a grub-screw. All that remains to be done is to drill a No. 60 oil-hole from the periphery of the sheave to the recess. Oil which bleeds from the main bearing will collect in the recess, and centrifugal force will ensure adequate lubrication of the strap and sheave.

Machine the flywheel by holding in the 3-jaw chuck, by the rim, and face the rim and boss. Reverse in the chuck and face the other side, then hold by the longer boss, centre and drill to fit the crankshaft. If you are uncertain of getting a good fit by drilling, drill undersize and finish with a small boring tool. Without removing from the chuck, carefully turn the rim to 1 7/8 in. diameter. If you are nervous about this latter operation the flywheel may be mounted on a stub mandrel, but the tendency to "chatter" is increased. Drill the longer boss No. 43 and tap 6 B.A. for a grub-screw. In the photographs, for which credit is due to Mr. C. J. Grose, the flywheel and eccentric are shown with cheese-headed screws. These are a temporary measure until I can obtain some 6 B.A. Allen screws.

Assembly calls for no special comment. Use graphited yarn for packing the piston and glands, and use oiled paper gaskets under the cylinder covers, and valve-chest and cover. Before fitting the valve-chest cover set the valve by



turning the crankshaft until the piston is at top dead centre. Hold the crankshaft in this position and rotate the eccentric (after slacking off the grub-screw) until it begins to descend. When the edge of the top steam port shows as a black line stop turning and fix the eccentric. The engine will run in the same direction that you turned the eccentric. Check on bottom dead centre to make sure there is no discrepancy anywhere.

Adequate lubrication is essential. A displacement lubricator with needle valve control will look after the "innards," and an oil box with 1/16 in. diameter capillary tubing feeds the main bearings and crosshead. In spite of the microscopic hole through this tubing it was found necessary to fit restrictors to these feeds, by which the oil supply can be controlled to a nicety.

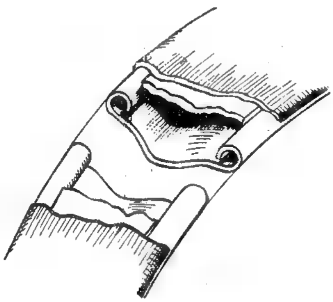
Speed, running light, with slightly superheated steam at 70 lb. per sq. in., is 4,500 r.p.m.

In a "One Manpower" Workshop

by F. T. Leightwood

LIKE, I suppose, many other readers of "ours" I have had to build my workshop up from very humble beginning, and by various purchases and exchanges, I at last came into possession of what I suppose is the important feature in most model workshops—a 3½-in. screwcutting lathe.

Included among the sacrifices was the petrol-engine which had taken the hard work off my legs when I had my old lathe, and so I was faced with the need for some form of drive. Electricity was out of the question and a petrol-engine would be rather awkward for such jobs as screwcutting, so I decided (rather reluctantly) on a treadle. To buy a suitable one for my lathe would cost £12 10s., which was too much for my pocket, but I had a couple of old motor-cycle wheels and I decided that I should have to make use of one of these. As the rear wheel had a flange with six holes in it for the hub-sprocket, this lent itself best to the purpose, and so I knocked out the old bearing-cups and fitted a pair of ball-races which I bought for the job. A long $\frac{5}{8}$-in. bolt became the spindle, this being fitted with distance-pieces between the inner races, the end of the bolt being screwed into a piece of 2 in. × $\frac{3}{8}$ in. bar for attaching to the lathe stand.



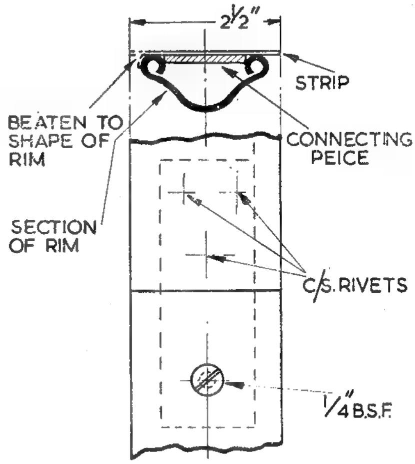
The stand consisted mainly of 1 in. × 1 in. × $\frac{1}{8}$ in. angle and as this material is not particularly rigid, I had to brace the 2 in. × $\frac{3}{8}$ in. bar which carried the wheel with various lengths of flat and angle bar, as the thrust made the wheel wobble considerably—which usually unshipped the belt.

In order to provide a surface for the belt, a strip of 16-s.w.g. steel 2½ in. wide was wrapped round the wheel and cut so that the ends just butted together. (See sketches).

A piece of $\frac{1}{8}$-in. plate (10-s.w.g.) just wide enough to fit between the edges of the wheel rim was riveted to one end, the band was then refitted to the wheel, and, using a tourniquet in order to hold it in close contact with the rim, a hole was drilled, countersunk and tapped ¼ in. B.S.F., and a screw fitted as tight as I could make it. The tourniquet was then removed and the part of the screw which couldn't be fitted into the countersink was filed down, leaving a reasonably true flat surface. To prevent side movement of the rim, the surplus width was carefully hammered down round the sides of the wheel-rim, this also helping to grip the wheel, although it is doubtful if the rim would slip with the combined friction of its own tension and over 3 ft. of belt.

The crankpin and treadle-pivot-pins are all *ex*-R.A.F. $\frac{3}{8}$-in. high-tensile steel bolts working in the slightly oversize holes produced by a $\frac{3}{8}$-in. drill. There is no point in introducing friction through too close a fitting hole when it is *your own* energy you are expending.

The connecting-rod was bent up from $\frac{3}{16}$ in. × $\frac{3}{8}$ in. steel, the ends being doubled over to provide more bearing surface in the holes.



The treadle itself consists mainly of an arm pivoted at the rear end and a plate attached with countersunk screws for the foot. To prevent side-movement and twisting of this main arm, a further length of angle was attached diagonally and pivoted in line with the main pivot. Well, I tightened the last nut, gave the wheel a trial run and made sure there was no binding, then I put the belt on.

First of all, the lathe couldn't be turned over *light*, and even when I had thoroughly oiled everything, I still couldn't make any headway, as the slightest cut stopped the works. I ought to have expected this, and so I began collecting all the pieces of flat bar and long bolts I could, and by fixing them around the spokes to build up the weight, I have made a considerable difference. Of course, the effect is anything but pretty, but when I can get hold of sufficient lead I will by melting it down and filling up the space between the rim and the band of 16-gauge steel.

To give some idea of the power available, I made a four-way toolpost from a solid cube of steel 3 in. × 3 in. × 3 in. This I roughed out by drilling, chipping and sawing, and then finishing on the lathe by turning and milling.

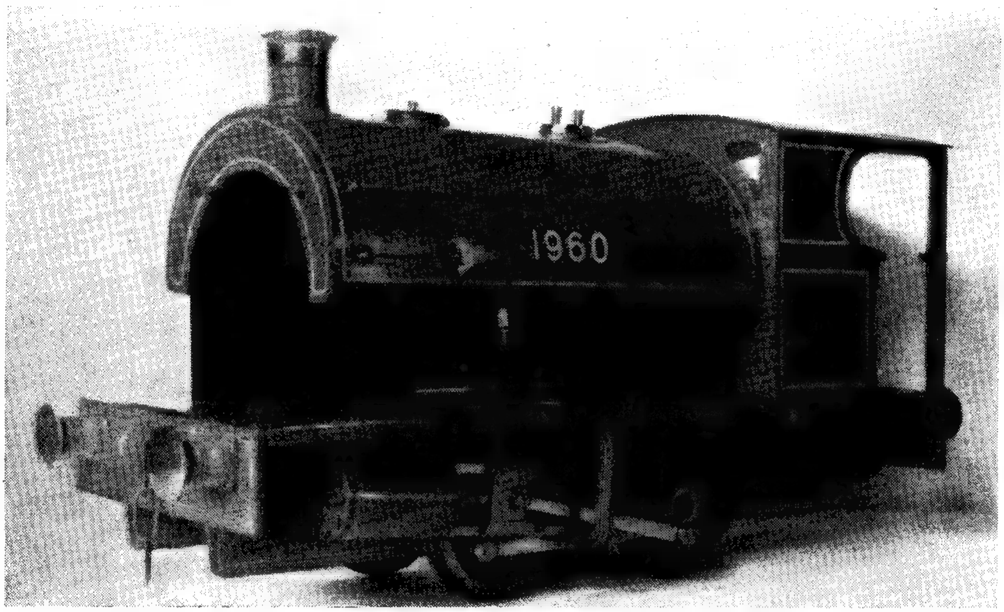
A Steam Locomotive at Last !

by G. A. Williams

IN THE MODEL ENGINEER dated October 27th, 1949, there is a description of a lathe which I built with the intention of building a locomotive. The lathe is still in its unfinished condition, as shown in the photographs published with the description, but it has achieved its object and the locomotive is now complete.

which is $\frac{1}{2}$ in. bore by $\frac{3}{8}$ in. stroke, the pump being driven by an eccentric on the driving axle.

The leading axle carries an eccentric for the drive to the lubricator, which is situated behind the buffer beam. This is similar to the one specified for *Juliet*, but has a larger tank. The wheels are $3\frac{3}{4}$ in. diameter pressed on to $\frac{5}{8}$ in.



A three-quarter front view of Mr. Williams's model industrial locomotive, Class No. 1960

By visiting various tracks and watching the performance of numerous types of engines, I finally decided on a 5 in. gauge four-wheeled tank, and shortly after at a club meeting, a fellow member produced an outline drawing, which had been sent to him by Messrs. Peckett. This drawing was borrowed, and an outline made to a scale of $1\frac{1}{16}$ in. to 1 ft., which is correct for 5-in. gauge.

The Prototype

At a later stage in the construction, I obtained a photograph which showed that the prototype is an industrial locomotive as made by Messrs. Peckett & Sons Ltd., of Bristol and is their class 1960.

The only castings used were the wheels, cylinders, hornblocks and eccentric straps which were cast from my own patterns, the remaining items have all been made from bar and sheet.

Frames are $\frac{1}{8}$ in. thick with $\frac{3}{16}$ in. plate buffer beams and gunmetal hornblocks generally to "L.B.S.C." design. A cross stay is fitted between the axles to take the axle-driven pump, diameter axles and are similar in design to the prototype.

Cylinders of scale size in gunmetal are fitted, the bore being $1\frac{1}{4}$ in. and the stroke 2 in. The port and bolting faces were machined on a friend's shaper and then the castings were bolted to the cross-slide of the lathe for boring and facing with a boring bar held in the chuck.

The ports are the same size as those specified for *Hielan' Lassie* and were drilled and chiselled to size. Slide-valves are also copied from the same locomotive, and are operated by the Stephenson valve-gear specified for *Juliet*.

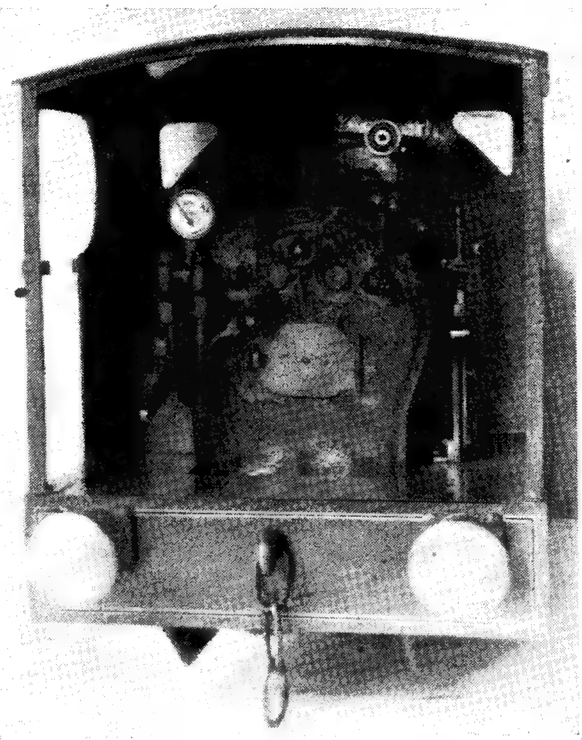
Boiler Details

The boiler is less than scale diameter, $\frac{1}{8}$ in. thickness of asbestos and 1/64 in. thick brass all round, bringing it to scale diameter. Twelve-gauge copper was used for the wrapper, firebox, smokebox tubeplate and girder stays, the back-head being $\frac{3}{16}$ in. thick. These two thicknesses were the nearest to the sizes required, which were obtainable at the local coppersmiths, and as some of the smaller pieces came out of his

scrap box at almost scrap price, these sizes were used.

The inside diameter of the boiler is $4\frac{7}{16}$ in. and with a $\frac{5}{16}$ in. water space around the firebox it accommodates twenty $\frac{3}{8}$ in. diameter and two $\frac{3}{4}$ in. diameter tubes. The boiler was brazed with the assistance of a club member and his oxy-acetylene equipment, and after staying, was tested hydraulically to 200 lb. per sq. in., the working pressure being 80 lb. per sq. in.

Four longitudinal stays are fitted, two solid and two hollow. One hollow stay is for the blower, and the other carries the boiler feed-water from two clacks on the back-head to the front of the boiler. These clacks were fitted in this position due to the fact that there is very little room on the boiler barrel under the saddle tank.


A view inside the cab, showing the fittings

The Regulator

For a regulator design, the one specified for *Doris* was used, but the levers were reversed to give anti-clockwise movement of the regulator lever to open. In order to keep dust from the eccentrics on the driving axle, the ashpan is screwed to the frames and forms a cover. The ashpan slopes backwards and the grate is retained by the usual pin. By pulling the pin, the grate falls down and slides backwards down the ashpan.

The smokebox is D-shaped and is built up from $\frac{1}{16}$ in. thick brass, except for the base-piece which is $\frac{3}{16}$ in. thick. This base is screwed by angle iron to the frames and forms a frame stiffener right above the cylinders.

For the saddle tank, 1/32 in. thick copper is used, the piece forming the outside being riveted and sweated to the end plates, and then a semi-circular inside piece is screwed and sweated to it to close the tank.

The chimney is soldered into the tank, and the tank bolts down on to the smokebox to form an air-tight joint. The other end is bolted to the cab front, leaving a $\frac{1}{8}$ in. air space between the boiler and the tank.

On the footplate at the left-hand side of the boiler is fitted the hand pump. The pump barrel and valve box are machined in a piece of 1 in. square brass bar $1\frac{1}{2}$ in. high, the operating lever being horizontal.

The cab and running boards are made from tinned sheet iron 0.020 in. thick, suitably stiffened.

With the usual quantity of water in the boiler and the tank empty, the weight is 77 lb.

When building the locomotive, I wondered if the boiler would make sufficient steam, as there is only 1 in. from the bottom of the tubes to the grate, the depth of the firebox being restricted by the eccentrics. I find, however, that the boiler will supply all the steam necessary for the cylinders when working continuously in full gear, using any type of coal. When using household coal, the steaming capacity falls after about one hour, but with anthracite and Welsh steam coal the boiler will steam for hours.

Performance

On the continuous track of the Urmston & District Model Engineering Society which is 528 ft. round, it has pulled twelve adults and has taken its part in regular passenger-hauling.

Last June the locomotive won "The Mary Griffiths" Cup of the Sale Model Engineering Club, which is the award in the annual competition for members.

All parts of this locomotive have been machined on the lathe, as previously described. The time taken has been two years, but no doubt this time would have been less if I had had better equipment.

To illustrate one of the handicaps, "L.B.S.C." can make union nuts at two per minute, whereas I was doing well to get one in ten minutes.

The lathe has proved its worth on this job, and it is now going to be finished and improved.

OUR DECEMBER 7th COVER

There has been quite a big demand for copies of the coloured cover of our December 7th issue, but there are still a few left, if any reader would like to have one. We would add that we are deliberately retaining a few copies in case we receive some requests from readers overseas who, of course, cannot send in their requests so quickly as "home" readers.

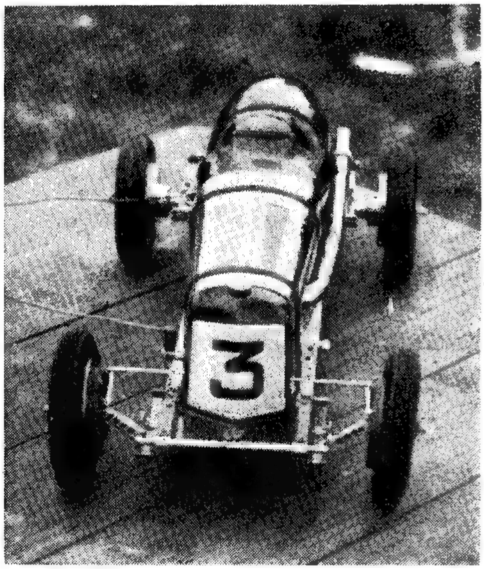
Model Car Supplement

The Trend in Design

by "Critic"

As I write this, tracks all over the country will be inches deep in snow, and thoughts of racing will be centred either around what has occurred during the past season, or what is likely to occur in 1951.

For the benefit of readers who expressed a no uncertain degree of doubt concerning the

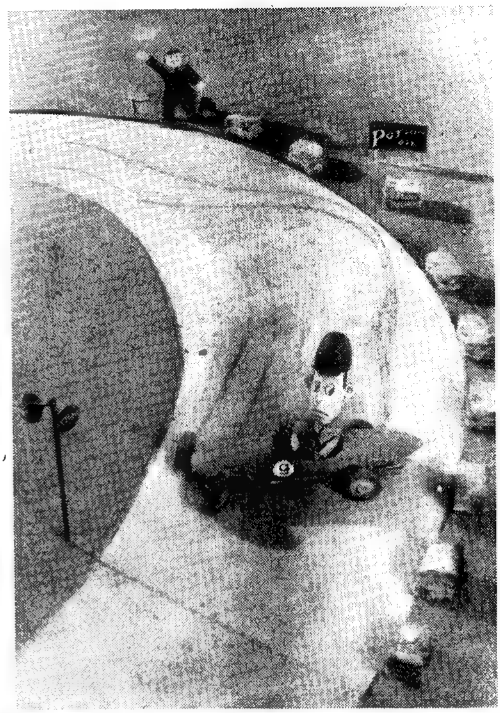


Yet another picture of the already famous Weaver E.R.A., a delightfully clean model

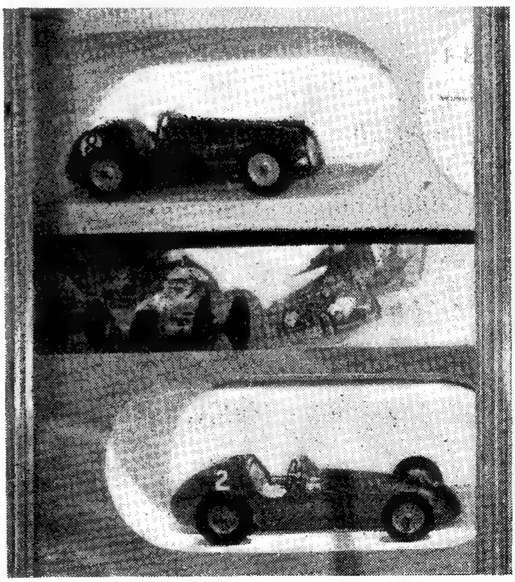
fitness of the model car to take its place in model engineering, we might do worse than to indulge in a brief survey of the position as it stands today. To do this effectively, we must revert, for a moment, to the early days.

In 1942, the year when model car competitions took root and started to grow, the majority of the models left little doubt as to the sources of inspiration for their origins. They were, in fact, mostly models of some known prototype, with centrifugal clutches, bevel back axles and suspension of one type or another. Their builders were self-recruited from the ranks of the model power boat fraternity and from other "approved" branches of model engineering.

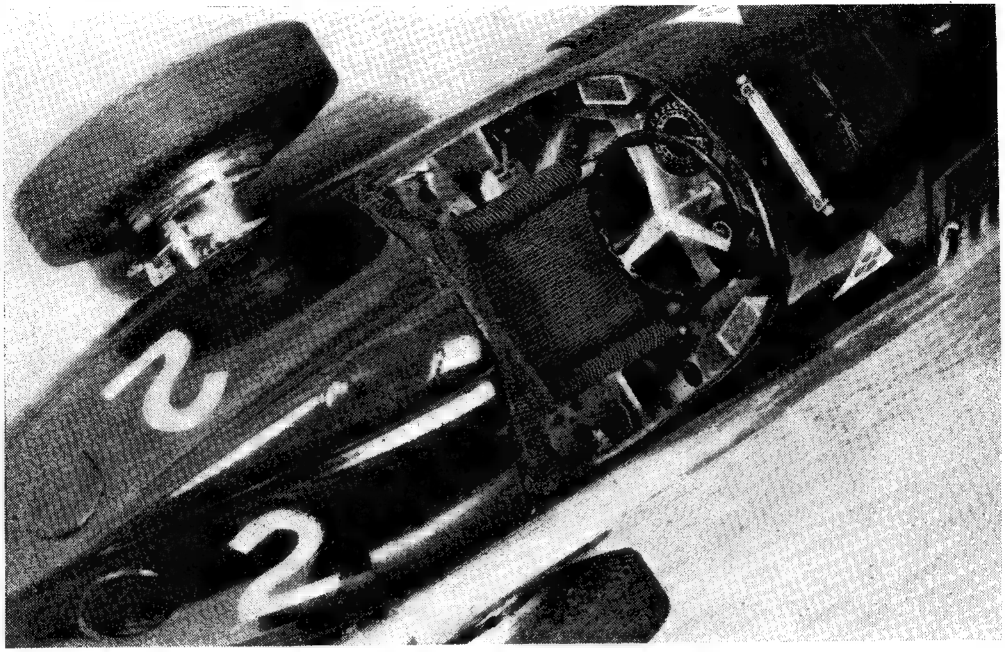
As time went by, speeds increased and with



"Round the Bend"! From a Xmas card by Mr. John Ahern



Two of Mr. Rex Hays' super scale models in the window of the "Daily Express" offices in Fleet Street. Top, Ferrari; bottom, San Remo 4CLT/48 Maserati

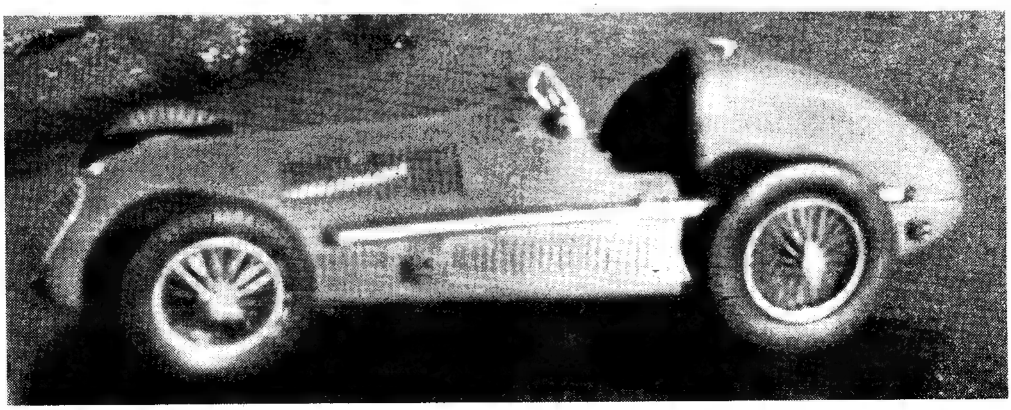


A close-up, showing cockpit and back axle details of the 158 *Alfa Romeo model by Rex Hays*

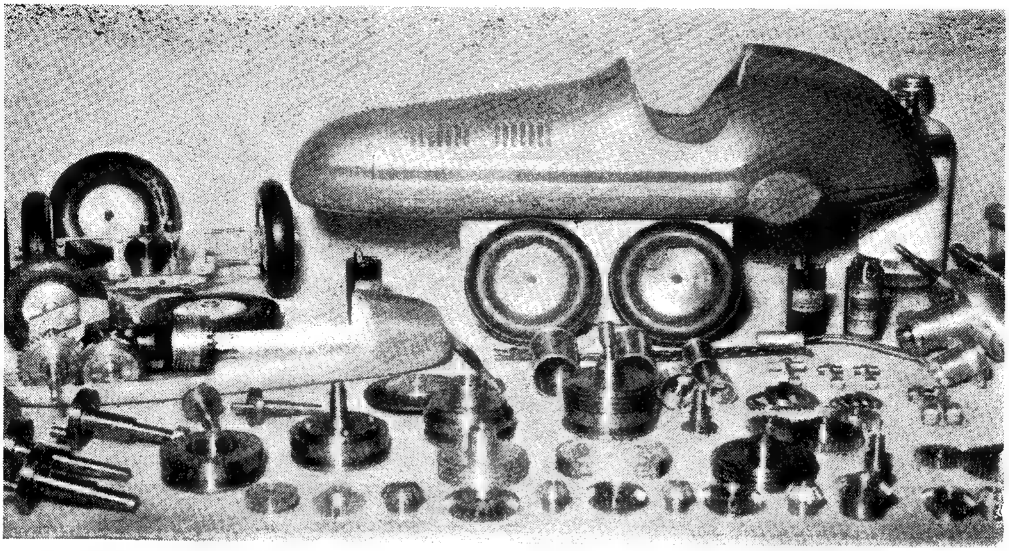
these came the unsupressable desire for even *more* speed. First, engines were tuned and retuned until they achieved what was thought to be far in excess of their maximum outputs ; then they were tuned again. Next on the list was weight reduction. This, of course, had been in mind for some time, and all through the " tuning " era, a process of pruning had been going on, so that, when weight reduction became the order of the day, there was mightly little left to prune!

But the demon Speed was hard at work and in ever-increasing numbers, model car designers fell before the sweep of his mighty arm. Realism went by the board, clutches became obsolete, suspension was billed as frivolous indulgence, and rear view mirrors, steering wheels, instrument panels, in fact anything which might connect the new brain child with the shadow of its ancestor was regarded as a mere frippancy of childlike mentality. Model car racing had become a fetish.

By this time, the sport had lost a number of its early pioneers. They, in their turn, were soon forgotten. Others, convinced that this was but a passing phase, continued their scale building, running their lovely little replicas against the sub-



Mr. Wainwright's San Remo Maserati. Note the mass of detail and spoked wheels



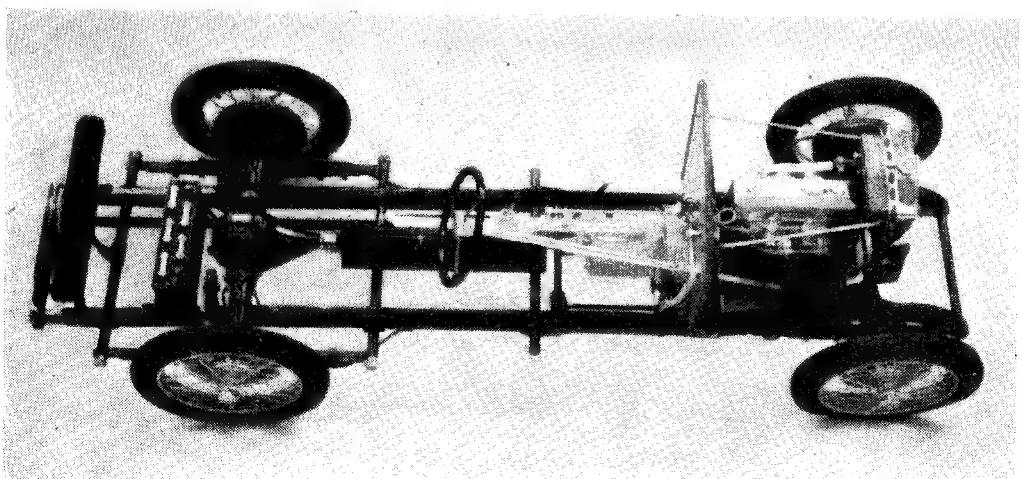
Showing some of the components that go into the construction of a real model car. Components and body by Z.N. Motors

scale monstrosities and, often, collecting the laurels by way of diversion!

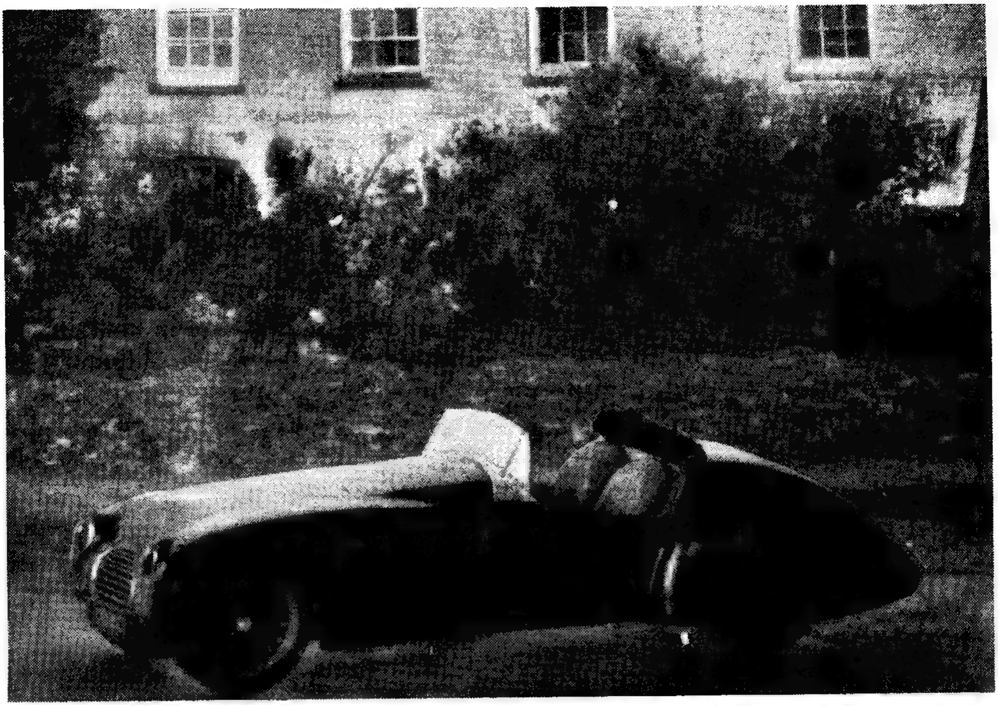
The model car movement owes much to these staunch participants ; indeed, *British* model car racing owes them their all, as witness the existing official records.

The past year saw more imported cars on the tracks than ever before. The Dooling 60 has been accepted as the racing engine *par excellence*, and its snob value in miniature racing circles is little short of fantastic. But to offset all this, a few British home-made engines have come once again into the limelight. Furthermore, the B.R.M. and the Alfa Romeo have found many admirers amongst the model-engineer minded participants, with the result that the trend in design is, to some extent, reverting back to its original form.

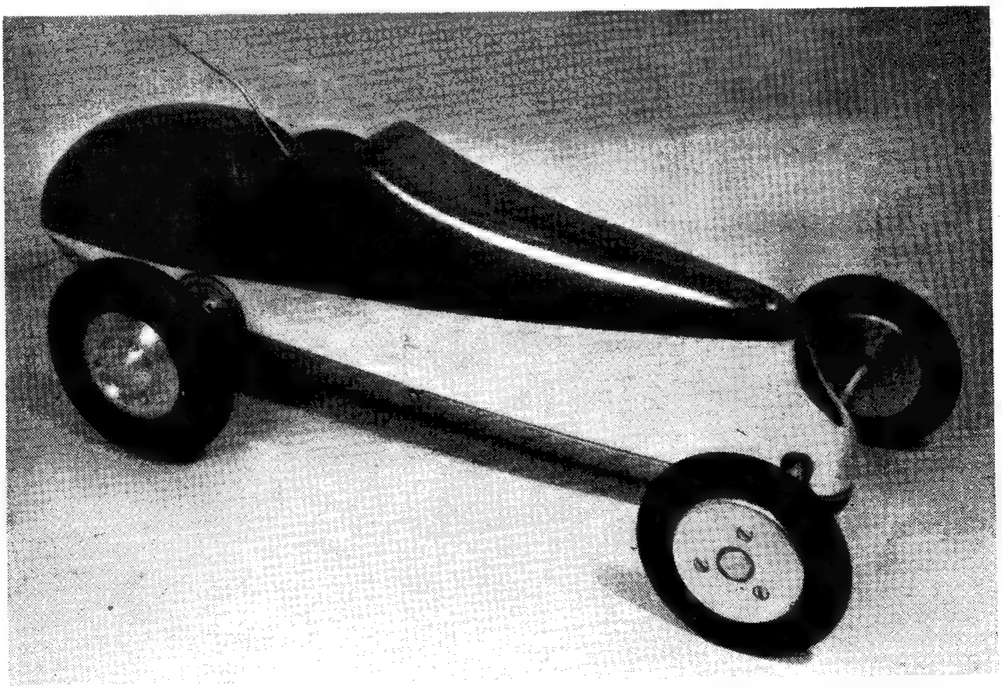
I would be guilty of ambiguity were I to suggest that the hell-for-leather cult is on the decline, but I think I am safe in saying that from the quality of craftsmanship seen in later models, it is evident that more and more attention is being lavished on appearance. From here, it is but a short step back to the true-to-scale miniature—and model engineering.



Would any reader suggest that this M.G. chassis is not 100 *per cent. model engineering*?



This model is reproduced approximately twice full size!



The Dooling Arrow, much sought after by the hell-for-leather fans. Model engineering? That's for you to decide

Typical American Cable Track Practice

by R. H. Warring

THE track described is a generalised one incorporating typical American practice; but at the same time largely based on the one-sixteenth mile track of the Valley Miniature Race Car Association at Ontario, California, although slightly smaller.

for this will aid in attracting people to your business.

" Fourth—keep shady trees in mind. Here you can build your benches for the contestants to work on their cars."

Marking-out the track consists of erecting a

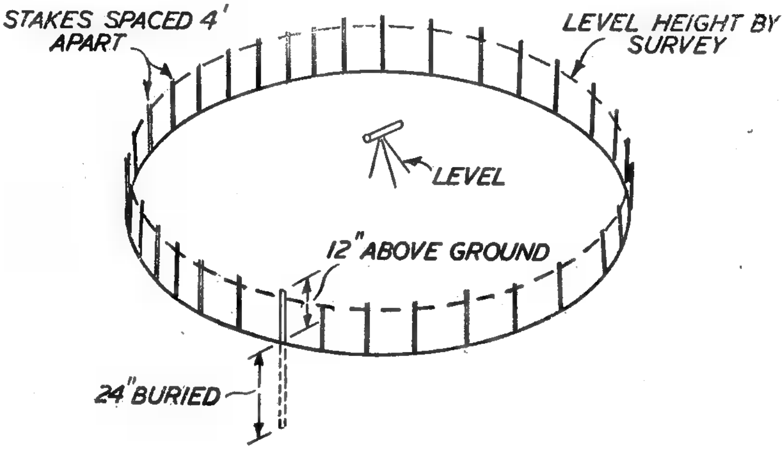


Fig. 1

As regards site, American recommendations are quoted complete :—

" First—find a site which is located on a popular road or highway. Simple directions will then bring many visitors and model race car fans to your track.

" Second—choose a site which is as level as possible to eliminate costly excavation. Drainage should be good so that rain will either flow quickly away or be absorbed in the ground without leaving water holes to undermine the track.

" Third—whenever possible, locate near a roadside stand, lunch wagon, gas station, etc.,

centre pole and from this describing two circles on the ground with a sharp stick, representing the outer and inner edges of the track. The outer diameter is 73 ft. and the inner diameter 67 ft., giving a 3 ft. wide track of 1/24th of a mile circumference. 2 in. × 4 in. stakes, 3 ft. long are then driven into the ground, each for a distance of 24 in. around the circumference of each circle, each stake being 4 ft. apart. The track layout is then levelled, marking on each stake the true level height as found by reference to the lowest and highest stake (Fig. 1). This is done as follows :—

A transit level should be used, set up over the

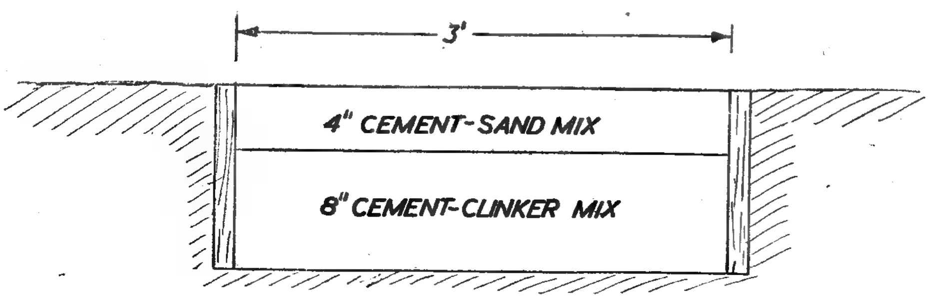


Fig. 2

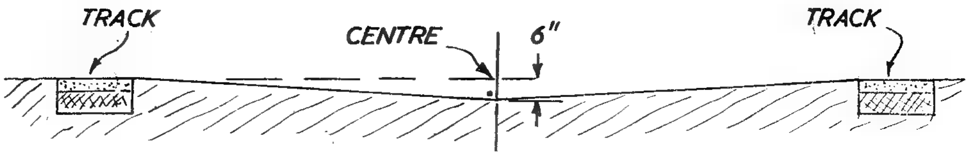


Fig. 3

centre. Measurements are taken, and recorded, against a surveyor's pole held on top of each outside stake in turn. The lowest and highest stakes can be located by this means. Mark the number of inches that the highest stake is higher than the lowest stake. The true ground level (with reference to the lowest point of the track) i.e. the lowest stake, can be determined for this point. Similarly, level each other stake around the outer circumference and then repeat for the inner circumference. The track outline can then be excavated accordingly to a depth of 12 in. all round.

Wooden forms—1 in. boards, preferably 12 in. wide—are then nailed between the stakes, the top edges of these boards corresponding with the top (level) surface of the track. The footings and surface can then be applied.

Footings consist of a mixture of five parts cinders to one part cement, kept rather dry, not wet. This is built up to a depth of 8 in., well consolidated by pummelling. The 4 in. thick concrete surfacing consists of three parts sand and one of cement, aiming at a float finish for the top surface. At least a week will then be required for the cement to dry and set, when the forms, etc., can be removed.

The infield is graded away 6 in. to the centre (Fig. 3). The first 8 ft. to 10 ft. should be excavated to a depth of 6 in. and filled with gravel, then surfaced with asphalt or tar to form the "apron" or area for the starting and stopping of cars (Fig. 4). Cars running off the track inwards are similarly given a better chance to recover than if they plunged immediately on to a relatively rough infield.

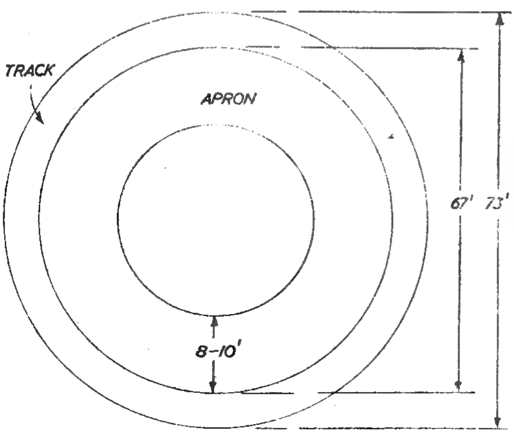


Fig. 4

The remainder of the infield must be kept reasonably smooth, either sowing with grass and keeping well trimmed or just rough levelling. There must be no projections which might interfere with the cable. There then remains to be established and consolidated the centre-pole fixing. The recommended design is shown in Fig. 5. Minimum diameter for the underground

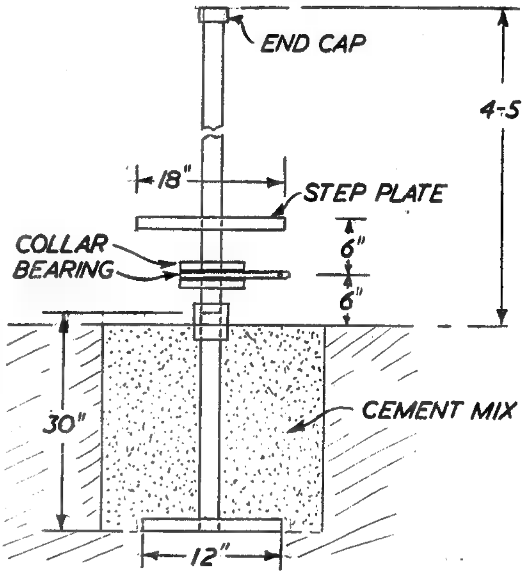


Fig. 5

section of pipe is $1\frac{1}{4}$ in. It could with advantage, be greater, reducing to $1\frac{1}{2}$ in. above the bearing and collar. Typical American practice in erecting the centre fitting is as follows :—

A 30 in. length of $1\frac{1}{2}$ in. diameter (or larger) pipe is threaded at both ends. A flat plate, roughly 12 in. in diameter, is screwed on to one end. The centre hole is then dug to a depth of 30 in. around the stake, taking care not to disturb the stake until the hole is almost completed. The stake is then removed, the hole completed and the underground assembly dropped in place. Another length of pipe is temporarily screwed into the upper end to serve as a datum point for locating the underground fitting in the exact centre of the circle. A line is stretched across the track from side to side, pulled tight and held just high enough to come over the new length of pipe added. A second line is then erected similarly, exactly at right-angles to the first. The inter-

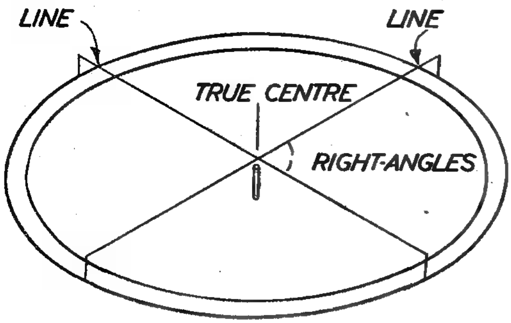


Fig. 6

section of these two lines gives the exact centre of the circle and the centre fitting can be adjusted and aligned accordingly (Fig. 6). The pipe must also be checked for true vertical. Guy wires are then erected to the upper length of piping to hold the fitting in exactly this position whilst the hole is filled in and consolidated. Material used is concrete—the 3 : 1 sand-cement mix previously used. The upper threaded portion of the underground pipe should just protrude above the level of the concrete. The guy wires are left in place for about a week to allow for setting. They can then be removed, together with the temporary length of piping.

A length of 1½ in. diameter piping is then threaded at both ends. Length is not critical, but is usually between 4 ft. and 5 ft. Two collars are made, about 1 in. wide, drilled to fit over the pipe and with set-screws for location. These are assembled over one end of the pipe 6 in. from the bottom with a large ball-bearing located between the collars. A ½ in. wide strip of steel or iron is then wrapped round the bearing, the ends brought together and held with bolts. It is cut off about 6 in. from the bearing and drilled with a ¼ in. diameter hole to take the cable attachment.

The step plate comes next, 18 in. in diameter and roughly 1 in. thick metal. This is welded to the pipe about 12 in. from the bottom. Ribs are sometimes welded on underneath to strengthen it. A pipe cap on the upper end completes the assembly.

This upper unit is de-mountable from the buried fitting, being erected when required and dissembled and stored away when not in use. A standard pipe coupling provides the joint. When dissembled the open end of the buried piping should be protected with a pipe cap.

The cable length is adjusted to give exactly

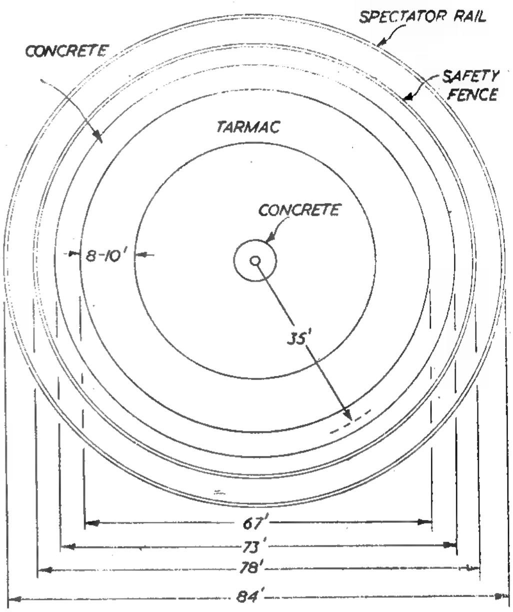


Fig. 8

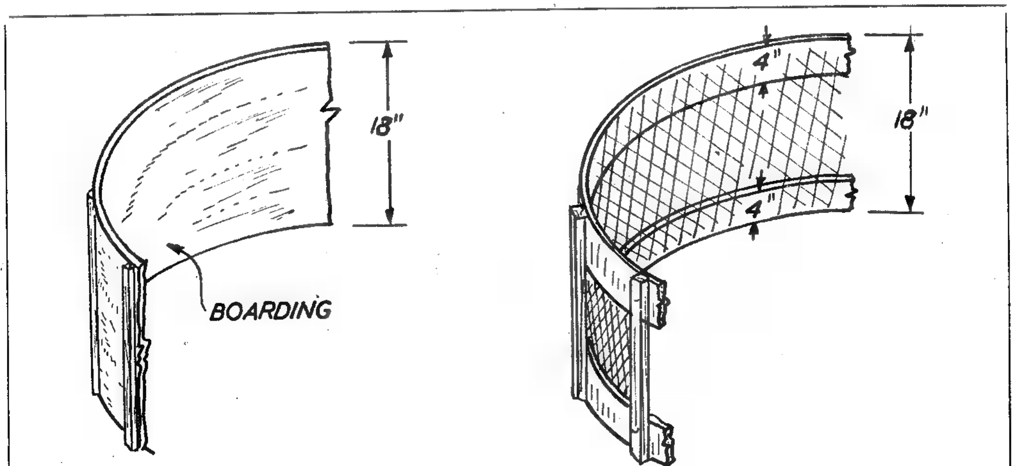


Fig. 7

35 ft. between the centre of the pole and the centre-line of the car. The bridle length being 9 in. from the car centre, due allowance must be made for this and the length of the cable fitting attached to the central pole. The car end hook should be capable of withstanding ■ pull of 400 lb.

Just what further embellishments are added to the track are largely a matter of preference and opportunity. Minimum requirement, however, is a crash wall. Here the 4 in. × 2 in. stakes used for laying out the track originally come into use. These are driven in around the circumference of a new circle 39 ft. in diameter, spaced 3 ft. apart and buried to ■ depth of 18 in. The boards used for the forms, supplemented by further stock, can then be nailed in place to complete ■ solid wooden wall 18 in. high. Alternatively, to save on cost, only the upper and lower part of the crash fence need be boarded, preferably with 4 in. boards. 18 in. wire netting is then nailed between these strips (Fig. 7).

One further layout circle is required—and this should be marked out before erecting the crash fence. This is 84 ft. in diameter around which is erected 4 ft., 4 in. × 4 in. stakes spaced at 6 ft. intervals. More wire netting is strung between these stakes, which now becomes the spectator rail. A suitable gate or opening should be incorporated for entry to the track itself. The completed track is shown in Fig. 8.

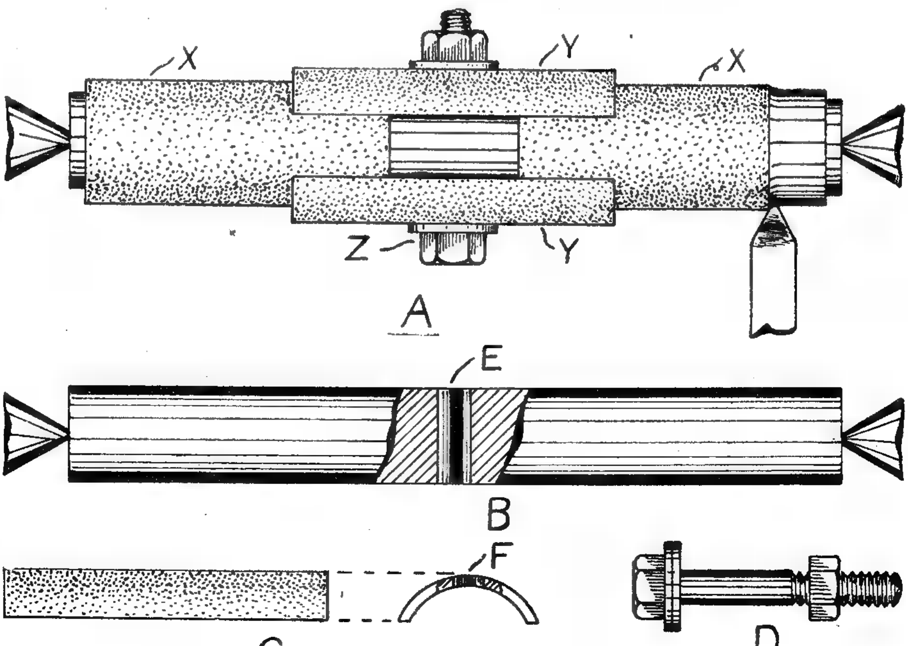
TURNING ENDS OF TUBING

THE model engineer is often confronted with the job of turning, and sometimes screw-cutting the ends of short lengths of tubing. In cases of lengthy pieces of tubing, a cone centre is often used to advantage, but the work is not quite so easy with short lengths unless the job is done on ■ long piece, and afterwards cut off to the required length with the hacksaw.

Quite ■ good method of dealing with short lengths of tubing is as follows: A suitable mandrel and set-up for turning the ends of short pieces of tubing is indicated in view *A* of the accompanying illustrations. Two pieces of tubing *X* are lightly forced on the mandrel and held secure by means of two straps *Y*, and the bolt *Z*, which passes through the mandrel. Mounted between the lathe centres, the ends of the tube may be turned as indicated, each tube treated by reversing the mandrel end for end.

The mandrel indicated in view *B* should be carefully prepared and turned with well made centres. Turn the mandrel ■ good fit to the tubing so that the pieces may be forced on by lightly jumping the mandrel on ■ hard wood block. The hole to take the bolt for fixing is indicated at *E*, and this should be as large as possible according to the diameter of tubing to be treated.

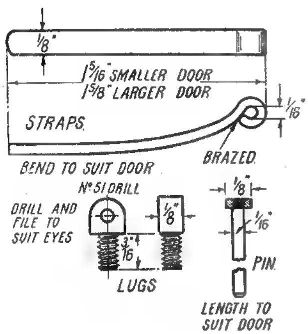
The straps for clamping down on to the pieces of tubing are cut from ■ piece of heavy hard drawn tube. One piece is indicated at *C*, with the hole drilled in the top at *F*, to take the fixing bolt. The bolt with two washers is indicated at *D*, and should be only just long enough, ■ indicated in view *A*. The mandrel should be packed away with care complete with the straps and fixing-bolt in order to be ready for any future use.—W. J. SAUNDERS.



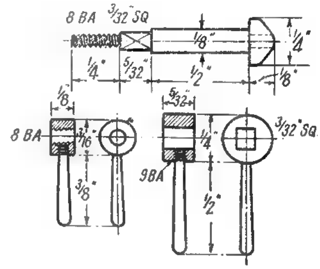
"L.B.S.C.'s" Beginners' Corner

Smokebox Accessories for "Tich"

BEFORE continuing the regulator instructions, let's insert the "missing links," which aren't links at all, says Pat, but the adornments for the smokebox doors. A door knocked up from a blank, and turned on the outside, or a turned casting, will need a separate pair of hinges riveted on. The easiest way to make the straps, is to bend them up from pieces of strip metal about 20-gauge. I have used both nickel-bronze and rustless steel, but ordinary steel does quite well; if blue steel is used, and bright hinges are required—cleaner boys on the L.B. & S.C. Railway always scoured up the smokebox door hinges and handles—the blue finish is soon rubbed off with a piece of fine emery-cloth. I cut my strips from ordinary sheet, using a pair of snips before I had the Diacro shear. It is easy enough to cut along a straight line if you are careful. The strips should be $\frac{1}{8}$ in. wide for either door; cut them a little over finished width, and bring to size with a smooth file. Bend the end over like a hook, with a pair of round-nose pliers; then put a piece of $\frac{1}{16}$-in. steel wire in the hook, and continue bending the metal around the wire, until you have a complete loop. The joint is then brazed; just put a dab of wet flux in the joint, heat to bright red, and touch it with a bit of thin brass wire. If the eye becomes stopped up by feeding in too much brass, it doesn't matter a Continental, just poke a No. 51 drill through it.



Hinge details



Dart and handles

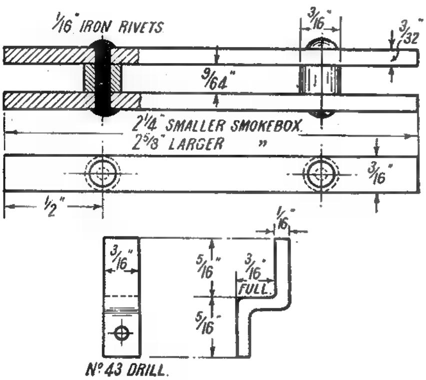
For the small smokebox, cut off the strips at $1\frac{5}{16}$ in. from the outside of the eye or loop; for the larger one, $1\frac{5}{8}$ in. is just right. Round off the ends, then apply one of the hinge straps to the door, $\frac{5}{16}$ in. above centre line for the smaller one, and $\frac{3}{8}$ in. for the larger one. You'll then see exactly how it needs bending, to lie in close contact with the door. Do the needful, then drill three holes in it to suit the fattest domestic pins that your wife, girl friend, or "mum" keeps in her work-basket. I use No. 57 drill, and have a supply of blanket pins; they are iron, but very soft, and make excellent rivets. One hole should be near each end of the strap, and one in the middle; countersink them. Put the strap in place on the door, holding it with a cramp, drill corresponding holes in the door, drive the pins through, snip off about $\frac{1}{16}$ in. from strap, and inside of door, and carefully rivet over the projecting bits of pin, hammering the outside ends well down into the countersink. I always use a bit of $\frac{1}{2}$-in. rod held vertically in the bench vice, as a riveting stake or dolly for this job; if the end of the pin is rested on the dolly, there is no risk of distorting the door. If it is distorted, it won't close airtight, and then I'll have umpteen letters telling me the boiler won't steam. When the straps are smoothed with a fine file, the rivets should be quite invisible.

Hinge Lugs and Pin

The lugs are made from $\frac{1}{8}$ in. × $\frac{3}{16}$ in. rod, nickel-bronze or brass. Chuck truly in four-jaw, and turn down $\frac{3}{16}$ in. length to 7/64 in. diameter; screw 6-B.A. Part off at $\frac{3}{16}$ in. from the shoulder, and round off the sharp corners. Now be careful about the next bit. Put the smokebox door in place, and fix it temporarily; this is easily done by cutting a bit of brass or steel rod, say about $\frac{3}{8}$ in. × $\frac{1}{8}$ in. section, a little longer than the diameter of the hole in the smokebox front. Drill a No. 40 hole in the middle, and tap $\frac{1}{8}$ in. or 5-B.A. Put this across the inside of the smokebox front, in the same position that the crossbar will occupy, and run an ordinary screw into it, through the hole in the door. Tighten up just sufficiently to hold the door tightly in place without distorting it. See that the door is absolutely slap in the middle of the smokebox front; a door put on "cockeyed" is a sign of sheer carelessness.

The eyes on the ends of the straps should touch the smokebox front; in full size they are clear of it, but they are far smaller in proportion to size, and if ours stick out a mile or so, it spoils the neatness. With the door in this position, make a centre-pop in line with the holes through the eyes, and $\frac{1}{16}$ in. below them.

Remove door, drill the centre-pop No. 44, tap 6-B.A., and screw the lugs in; then replace door, poke a No. 51 drill down the holes in the eyes, and continue right through the lugs. I can almost hear some beginners asking how the merry dickens are they going to do that, when the drill chuck won't clear the smokebox front. As I often say, everything is easy when you know how. Chuck a piece of $\frac{1}{8}$-in., or even 3/32-in. round rod in three-jaw; brass, bronze or steel, doesn't matter which. Face it, centre, and drill down about $\frac{1}{4}$ in. with No. 52 drill. Hold a No. 51 drill in the bench vice, point downward, between two clams, soft copper for preference, with just over $\frac{1}{4}$ in. of the shank projecting. Carefully drive the drilled end of the bit of rod on to the shank, and you have an extension drill that will do the required job like the girl on the flying trapeze. When the drill has gone through the upper lug, don't pull it out, but push it straight down into the lower one, and carry on with the drilling, the upper eye and lug acting as a drilling steady. Warning—be careful not to move the brace to either side, or you'll either break the drill, or bend the shank just above the extension piece. If the drill doesn't fit tightly in the extension, just solder it. If I happen to break a drill (which is a rare occurrence, though it happens sometimes, as I am still a human being and not driving the *Astral Belle* yet) the Scottish part of my ancestry won't let me throw it away. I make an extension for the point end, and regrind the shank end, which does for rough jobs, so I then have two drills in place of one, ye ken—hoots, mon, awa' wi' ye!



Crossbars and brackets

The hinge pin is made from $\frac{1}{16}$-in. round silver-steel. Chuck in three-jaw, and put about three or four threads on the end, $\frac{1}{16}$ in. or 10-B.A. Chuck a bit of $\frac{1}{8}$ in. round rod, centre and drill it about $\frac{3}{16}$ in. deep with No. 55 drill, and part off at $\frac{1}{8}$ in. from the end. Tap the hole to match the pin, screw it on tightly, chuck in three-jaw again, and trim up the head to a flat button shape. Cut the pin off just long enough to project about $\frac{1}{16}$ in. below the bottom lug when in place; round off the end. Finally, carefully trim off with a fine file, any part of the lugs which is projecting beyond the eyes, so that eyes and lugs are same width, as shown in the illustrations. This makes a nice neat finish.

Dart and Crossbar

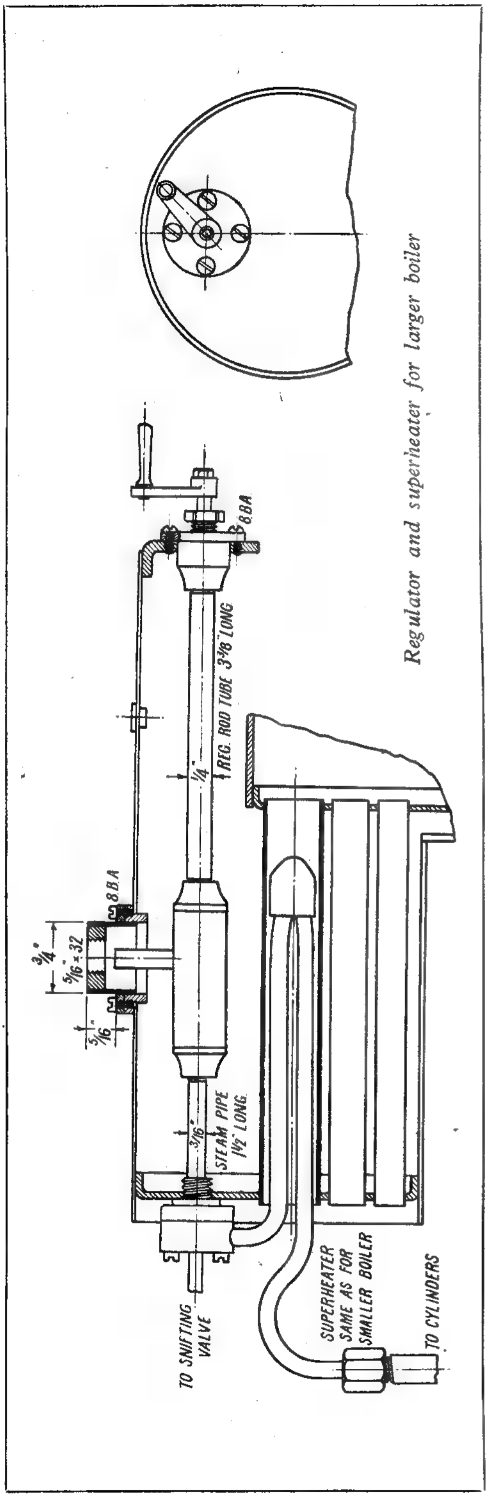
The dart, which is the engineman's name for the locking bolt, can either be turned from the solid, or built up. In the former case, chuck a piece of $\frac{1}{4}$-in. round steel rod in three-jaw; face the end, and turn down a full $\frac{1}{4}$ in. to a bare 3/32 in. diameter. Turn down the next 21/32 in. to $\frac{1}{8}$ in. diameter; then push the rod back into the chuck jaws until only 5/32 in. of the $\frac{1}{8}$ in. part projects, and file that square. I have already described how to file true squares, using one of the chuck jaws as a guide, so need not go over all that rigarole again. Screw the little end piece with an 8-B.A. die in the tailstock holder, then pull the rod out of the chuck jaws again, far enough to part off at $\frac{1}{8}$ in. behind the shoulder, leaving a round head $\frac{1}{8}$ in. thick. File this flat both sides, to the same thickness as the round part, then finish it off to the shape shown in the illustration, and the job is done.

To build up the dart, simply chuck a bit of $\frac{1}{8}$-in. round rod, turn down $\frac{1}{4}$ in. of the end, and screw as above. File the next 5/32 in. to a square, also as above, then part off at $\frac{5}{8}$ in. from the squared part. Reverse in chuck, and turn [illegible] in. of the end to $\frac{1}{16}$ in. diameter. File the head from any odd scrap of steel $\frac{1}{8}$ in. thick, then drill a $\frac{1}{16}$-in. hole in the middle of the long straight side. Push in the $\frac{1}{16}$-in. end of the spindle, and braze the joint with brass wire; clean up, and the result is as good as one made from solid.

For the key, chuck the $\frac{1}{4}$-in. rod, centre, and drill a 3/32-in. hole about $\frac{3}{16}$ in. deep; part off a 5/32-in. slice, and file the hole square, with a watchmaker's square file, until it fits easily on the squared part of the dart. For the locking handle, chuck a bit of $\frac{3}{16}$-in. steel rod, face, centre, and drill about $\frac{3}{16}$ in. depth with No. 51 drill; part off a $\frac{1}{8}$-in. slice, and tap it 8 B.A. Drill a No. 53 hole in the thickness of each, and tap it 9 B.A. The handles are made from bits of 3/32-in. silver steel, or rustless steel if you so desire, filed slightly taper whilst running at high speed in the lathe; the smaller end is screwed 9-B.A. to fit the tapped holes in the round bosses, and the outer ends are slightly rounded off. The illustrations show the assembly.

The crossbar is an exceedingly simple job, being composed of two bits of 3/32-in. × $\frac{3}{16}$-in. steel rod, cut to length to suit smokebox. At $\frac{1}{2}$ in. from each end, drill a No. 51 hole in one of the bars, and use it as a jig to drill the other. For the spacers, chuck a piece of $\frac{3}{16}$-in. round steel rod; centre, drill about $\frac{3}{8}$ in. depth with No. 51 drill, and part off two slices 9/64 in. thick. Put these between the bars, opposite the holes, put $\frac{1}{16}$-in. iron rivets through, and rivet up as shown.

The brackets are bent up from $\frac{1}{16}$-in. × $\frac{3}{16}$-in. steel strip; cut a bit off any odd scraps of 16-



Regulator and superheater for larger boiler

gauge sheet, that may be lying around. I keep three boxes handy, and throw into them any "trimmings" of sheet steel, copper, and brass, that are left over after doing any sheet-metal job. Since I had the Diacro shear and bending gadgets, these boxes have supplied jolly nearly all the bits of angle, channel, etc. that I have needed, and in double-quick time, too. The illustration gives the measurements. To erect the brackets, put the crossbar in position, and set the brackets to it. Shut the door, hold the crossbar in position horizontally across the hole, poke the dart through the crossbar, and through the hole in the middle of the door. First put on a $\frac{1}{8}$-in. steel washer, then the square-hole key, with the handle hanging down; finally the locking handle, screwing it up tightly enough to hold the crossbar in place. Then all you have to do, is to put a bracket at each end of the bar, and attach the bracket to the back of the smokebox front (says Pat) with an 8-B.A. screw. If any of the screw sticks out beyond the front of the plate, file it off flush. The whole assembly is shown in the illustrations of the complete smokeboxes. If preferred, the brackets may be riveted to the plate, at each side of the door hole; but if you rivet, take good care not to give the plate an accidental clout which might distort it. If the door doesn't close airtight, you won't get any steam.

Smokebox Attachments

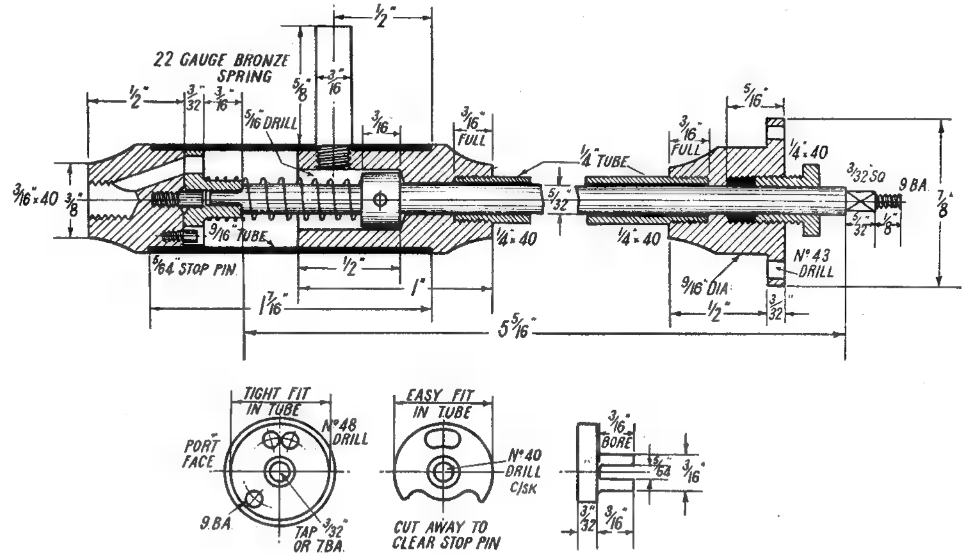
It doesn't really matter about making provision for attaching smokeboxes to frames, until we are ready to erect the boiler; but if the job is done now, they will be all ready. The smaller smokebox needs a strip of 16-gauge metal, $2\frac{1}{2}$ in. long and $\frac{3}{8}$ in. wide, riveted along each side, flush with the bottom, as shown in the recently illustrated section. This not only increases the overall width to the required distance between frames, but allows the whole bag of tricks to be fixed to the frames by a screw at each corner, where the side strips project beyond the smokebox. See coming notes on erecting the boiler.

The larger smokebox is supported by a cast saddle. Our approved advertisers will do the needful, and all the casting needs, is cleaning up with a file. The smokebox shell should bed nicely down into the seating; a half-round file will soon remove any roughness. If a piece of medium emery-cloth is wrapped around the smokebox shell, and the saddle rubbed up and down it a few times, the seating will match the curve of the smokebox barrel—not *exactly*, I hasten to add for the benefit of Inspector Meticulous, but near enough to allow the smokebox to seat well home. The sides and ends may also be introduced to the emery-cloth, after filing off any roughness, if a posh finish is desired; the saddle should just fit nicely between the frames, not tightly enough to push them apart, but tight enough to "stay put" without slipping down. It is not fixed to the smokebox until the erection job is in hand.

Regulator for Larger Boiler

Owing to the squat inner dome carrying a direct-action safety valve, we cannot use the high type of regulator described for the smaller

boiler; so here is another type which will be O.K. for the job in hand, as it requires practically no headroom. It is of the "disc-in-a-tube" pattern; and this particular version of it was schemed out by your humble servant many years ago, to obviate the need for making the tube full diameter for its full length, like that described in the *Live Steam Book*. The long tube, with a lot of "pinholes" in the top, to collect steam, is, however, ideal for a watertube boiler which has no dome at all. The dome on the outer casing of watertube boilers, is usually a dummy. Incidentally, the arrangement shown, is another one of many items described in these notes, which have been adopted commercially, in certain instances without as much as a by-your-leave, or even a word of acknowledgment.



Regulator details for larger boiler

The barrel consists of a piece of $\frac{9}{16}$-in. thin brass or copper tube (treblet tube if available) squared off at both ends in the lathe, to a length of $1\frac{7}{16}$ in. For the throttle block, chuck a piece of $\frac{9}{16}$-in. round bronze or gunmetal rod in three jaw. Face the end, centre deeply enough to make a countersink, and drill to $\frac{3}{16}$ in. depth with No. 48 drill; tap 3/32 in. or 7 B.A. Turn down $\frac{3}{16}$ in of the outside, to a tight fit in the barrel; part off at $\frac{1}{2}$ in. from the end. Reverse in chuck, gripping by the reduced part, then turn the end to the outline shown, centre, drill 5/32 in. or No. 22 for $\frac{1}{4}$ in. depth, and tap $\frac{3}{16}$ in. $\times$ 40. Now watch your step very carefully: at a bare 3/32 in. from the edge of the faced end, make two centre pops a bare 3/32 in. apart; and from them, drill two No. 48 holes slantwise into the tapped hole. The easiest way for beginners to get a fair start, is to drill straight in until the drill has just entered to its full diameter; no more and no less. Then shift the handbrace until the drill points towards the tapped hole, and carry on. Be extra careful as the drill is breaking through, or that won't be the only break! I advise hand drilling for beginners on this job, although it is fairly easy for them on a machine, the block being held in a machine-vice on the table, and the table tilted to correct angle. If the table doesn't tilt (mine doesn't) simply put the block in the machine vice at correct angle, sighting it against the drill, exactly as I described for drilling passageways in the cylinders.

On the opposite side of the face, approximately $\frac{1}{8}$ in. off centre, and close to the edge, drill a No. 53 hole, and tap it 9-B.A. for the stop pin, which is just a bit of 15-gauge wire (bronze or rustless steel) screwed to suit. It should project 3/32 in. from the face. The pivot pin is similar, but 3/32 in. diameter. Before screwing in these pins "for keeps," face off the surface exactly as described for slide valves, and be mighty careful not to tilt the block when rubbing it on the emerycloth, or you'll never get a true face in a thousand years.

For the valve, chuck a bit of $\frac{1}{2}$-in. rod of a different grade from that of the block. Face the end, turn down $\frac{3}{16}$ in. length to $\frac{3}{16}$ in. diameter, and part off at a bare $\frac{1}{8}$ in. from the shoulder. Reverse in chuck, centre deeply to form a countersink, then drill down about $\frac{1}{8}$ in. with No. 40 drill, as the valve needs to be very easy on the pivot pin. Face off the end; then slot the boss to a full $\frac{1}{16}$ in. width, which is easily done by cutting with a hacksaw and finishing with a watchmaker's flat file. Drill two No. 48 holes as close together as possible, corresponding with those in the port face, but run them into a slot,

as shown, by aid of a rat-tailed file. Finally, file a segment out of the bottom, as shown, to allow the stop pin to regulate the movement; the exact length of the segment is a matter for trial and error. When the valve is turned in an anti-clockwise direction, the end of the gap should be against the pin, when the slot is exactly coinciding with the two holes in the portface. When the valve is turned clockwise, the pin should be at the other end of the gap, after the hole has moved off the ports and travelled about 1/32 in. beyond them, so that they are overlapped by that amount of metal. When you have the gap O.K., face off the valve, same as the portface. Put a spot of cylinder oil on the faces, and they will stick together, and be quite steamtight, if the facing has been properly done.

Guide for Regulator Rod

The plug at the opposite end of the tube, forms a guide for the regulator rod, as well as a socket for the tube carrying the rod. Chuck the $\frac{9}{16}$-in. rod again, or a similar-sized piece of brass rod; face the end, centre, and drill down about $1\frac{1}{8}$ in. depth with No. 21 drill. Open out to $\frac{1}{2}$ in. depth with $\frac{5}{16}$-in. drill, turn $\frac{11}{16}$ in. of the outside to a tight fit in the tube, and part off at 1 in. from the end. Reverse in chuck, turn the outside to outline shown, open out the centre hole for $\frac{3}{16}$ in. depth with No. 3 or 7/32-in. drill, and tap $\frac{1}{4}$ in. × 40. Squeeze this into one end of the barrel; then at $\frac{1}{2}$ in. from the end of the barrel (that is, $\frac{13}{16}$ in. from the extreme end) drill a 5/32-in. hole through tube and plug, right into the enlarged hole in the plug (see section) and tap it $\frac{3}{16}$ in. × 40 for the dry steam pipe going up into the dome. This is a $\frac{3}{4}$-in. length of $\frac{3}{16}$-in. tube with a few $\frac{3}{16}$-in. × 40 threads on one end, and is not attached until the regulator is erected in the boiler, when it is screwed in through the dome bush.

The regulator rod is a piece of 5/32-in. round rod, phosphor-bronze or rustless steel, $5\frac{5}{16}$ in. long. One end is squared and screwed exactly as described for the rod in the smaller boiler, and will need a similar handle. File two flats on the opposite end, leaving a tongue between, which is an easy fit in the slot in the boss of the valve, but not slack. This tongue should be 1/32 in. less than the length of the slot, and is filed in the same manner as a square, but only on opposite sides instead of on four sides. For the collar, chuck a bit of $\frac{1}{4}$-in. round brass rod in three-jaw, face, centre, drill about $\frac{1}{4}$ in. depth with No. 23 drill, and part off a $\frac{3}{16}$-in. slice. Press this on to the tongued end of the regulator rod, so that it is approximately $\frac{5}{8}$ in. from the tongue; it should be a fairly tight fit. Put the rod, longer end first, down the regulator tube until the tongue is just about to enter; then put the valve and throttle block on it, the slot in the boss going over the tongue, and press right home. If the rod has about 1/32 in. end play, and can be twisted either way until the ends of the gap in the valve hit the stop pin, the collar is set correctly. If too much end play, shift the collar farther away from the tongue; if not enough play, shift it nearer. The 1/32-in. end play is needed, to allow for expansion. When you have it right, take out the rod, pin the collar to it with a $\frac{1}{16}$-in. pin made of bronze wire, driven through a No. 53 hole drilled through collar and rod. Replace rod, valve, and throttle block; but this time, put a spring, wound up from 22-gauge hard bronze or brass wire around a $\frac{3}{16}$-in. rod, between valve and collar, and see that the steam ports in the block are level with the hole for the vertical steam pipe in the tube. When the block is pressed right home, the valve should work easily by operating the rod between finger and thumb. The illustration clearly shows the assembly.

Gland Fitting

If a casting isn't available for the gland fitting, turn it from $\frac{7}{8}$-in. brass rod held in three-jaw. Face, centre, and drill down about $\frac{5}{8}$ in. depth with No. 21 drill. Open out to $\frac{3}{16}$ in. depth with 7/32-in. drill, and tap $\frac{1}{4}$ in. × 40. Turn down $\frac{1}{2}$ in. of the outside to $\frac{9}{16}$ in. diameter, and further reduce $\frac{5}{16}$ in. length to outline shown. Part off at $\frac{5}{8}$ in. from the end. Reverse in chuck, open out with 7/32-in. drill to $\frac{5}{16}$ in. depth, tap $\frac{1}{4}$ in. × 40, and fit a gland as described for the other regulator. Drill four No. 43 holes in the flange, for the fixing screws, and scrape off any burrs. Cut a piece of $\frac{1}{4}$-in. brass or copper tube $3\frac{3}{8}$ in. long; the hole through this must be big enough to let the regulator rod pass through easily. Put about $\frac{3}{16}$ in. of $\frac{1}{4}$ in. × 40 thread on each end; push it over the rod, and screw into the guide at the end of the regulator barrel. Screw the gland fitting on the other end. Cut a $1\frac{1}{2}$ in. length of $\frac{3}{16}$-in. copper tube, put about $\frac{3}{16}$ in. of $\frac{3}{16}$ in. × 40 thread on one end, and $\frac{5}{16}$ in. on the other; screw the shorter-threaded end into the throttle-block, with a taste of plumbers' jointing on the threads, and the regulator is ready for erection.

How to Erect

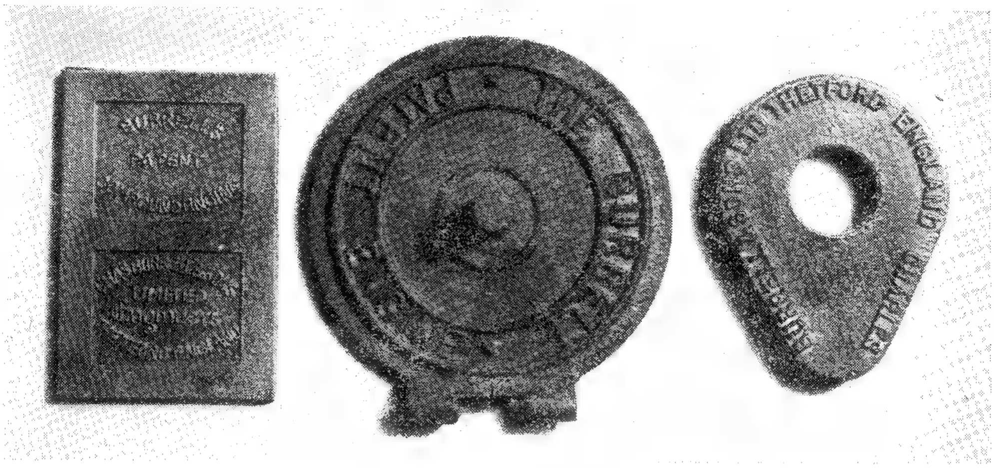
Open out the $\frac{3}{8}$-in. hole in the backhead to $\frac{9}{16}$ in. diameter, with drill and reamer. Insert regulator, until the flange of the gland fitting comes up against backhead. See that the steam pipe hole comes under the dome bush; put the vertical steam pipe temporarily in place, making sure it stands quite upright. Then locate, drill, and tap the screw holes on the backhead, exactly the same as fitting a cylinder cover; remove regulator, and then replace with a 1/64-in. Hallite or other jointing gasket between the flange and backhead, and secure the flange with four 8-B.A. brass round-head screws, smearing the threads with plumber's jointing. Pack the gland with graphited yarn, and fit the handle, exactly the same as for the smaller boiler. Screw in the vertical steam pipe; make and fit a steam flange at the smokebox end, exactly as described for the smaller boiler, and the job is done. The superheater is made and fitted exactly as described for the smaller boiler; and the dome will be described, all being well, along with the safety-valve.

Tail Lamp

Will at least 50 per cent. of my correspondents please note that it is *HIElan' Lassie*, and *not HEIl*—Hitler!

Model Traction Engine Supplies

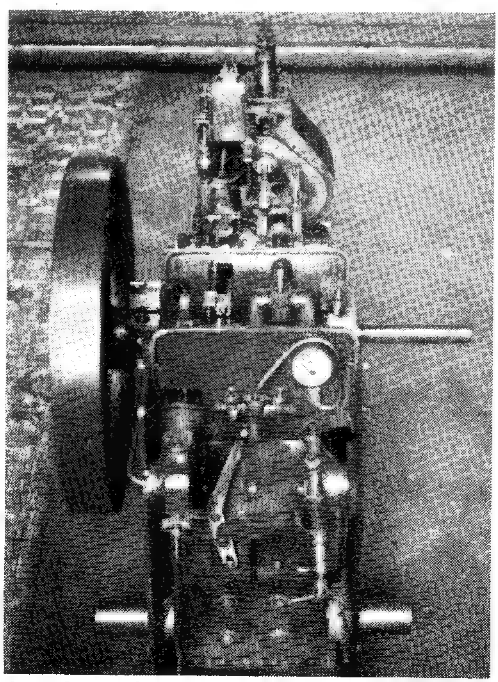
A. J. EVERY, 33, Williams Road, Ealing, London, W.13, has sent us copies of his Burrell engine are seen in one of the photographs reproduced herewith. They include the



Castings supplied by Mr. A. J. Every for the model Burrell traction engine

latest price lists of castings, parts and materials. As readers know already, he specialises in miniature traction engines, but the lists cover some rather unusual models of other types; for, in addition to the $1\frac{1}{4}$-in. scale Greenly traction engine, the 1-in. scale "M.E." traction engine, the $1\frac{1}{2}$-in. scale Burrell single-crank compound traction engine, and the "M.E." i.c.-engined road roller, there is a horizontal mill engine, a $1\frac{1}{2}$-in. scale portable overtype engine and a 1-in. scale steam travelling crane. For most of these things, blueprints are available.

We have seen many examples of these castings and they are clean, sharp and of excellent quality; some of the minor ones for the valve-chest covers, a rear wheel hub and the smokebox door, all of which carry their correct lettering reduced to scale.



A good start by Mr. E. W. Balson on his $1\frac{1}{2}$-in. scale model Burrell traction engine

That these castings and parts make up into really good models may be judged by the second photograph, which shows some of the "top works" of an Every $1\frac{1}{2}$-in. Burrell traction engine in course of construction by Mr. E. W. Balson, of Southampton. A notable feature is the correctness of the details; yet the model, after it was finished, proved itself capable of hauling a load of six adults and two children, without any difficulty. A photograph, showing the engine actually hauling this load is, unfortunately, not good enough for reproduction.

*An Experimental Steam Turbine Plant

A chronicle of many endeavours and trials in the quest for high r.p.m.

by D. H. Chaddock

A MEANS was now wanted of measuring the power and speed of the turbine and of providing it with a load approximating to that of a propeller. A fellow member of the S.M.E.E., Mr. L. Robinson, B.Sc., drew my attention to an article in the *Aeromodeller* dated March, 1949, describing the use of a calibrated torque bar, or fan brake, for testing model aero engines.

The idea is really very ingenious and simple. A number of rectangular bars all of the same cross section, 1 in. × ½ in., are made of any convenient material, but hard wood or hydulignum is recommended. The bars can be any convenient length from 4½ in. to 10½ in. long in steps of 1½ in. to suit the expected power and speed of the engine under test. A nomogram is provided to enable the approximate engine torque and therefore horsepower to be calculated at any speed from 2,000 to 10,000 r.p.m.

For the benefit of readers who may wish to make use of the idea, and who have not ready access to the article mentioned, Fig. 15, prepared by Mr. Gerrard from data given in the *Aeromodeller* (to both of whom due acknowledgment is made) may be useful.

Absolute accuracy is not claimed, but in development testing it is not always necessary. If, with a certain torque bar in one test a certain speed is obtained and then, after modifications to the plant, the next test shows a higher speed still, then there can be no doubt that the power has gone up too, and the chart shows approximately how much. Anyhow, that is the way I have used it and found it most valuable. All the results to be mentioned hereafter are in terms of the standard *Aeromodeller* torque bar.

Test Bench Equipment

Since the plant was destined for eventual installation in the 24 in. "M.E." hydroplane hull to Mr. Westbury's design, it was convenient to have the components in the same relative position on the test bench as they would ultimately occupy in the hull.

The photograph, Fig. 16, shows the test bench with the plant installed, the two longitudinal bearers representing the twin internal keels of this particular design. The drive from the turbine main shaft is taken on a long shaft simulating the propeller shaft, supported at its far end on a single ball-race and carrying the torque bar. Just inside the bearing is a single-start worm wheel engaging a 72-tooth clock wheel on an overhung shaft, at the other end of which is an indicating pointer. Even at 10,000 r.p.m. main shaft speed the pointer revolves sufficiently slowly for a specified number of revolutions, usually 20, to be counted and timed against a stopwatch and so the speed determined.

An excellent pressure gauge, *ex*-Government stock, reading to 1,500 lb. per sq. in., is connected to the water side of the flash boiler because I did not fancy risking its "innards" with superheated steam. The pressures recorded are therefore strictly water pressures and the steam pressures must be slightly lower, but with such a short boiler and superheated steam the difference is probably insignificant.

Single Nozzle Runs

In order to work the plant up to power gradually and avoid, if possible, catastrophic smash-ups, the first steam runs were made with a single nozzle only in operation, the other being blanked off by a blind dummy, the pump speed and blowlamp power being reduced accordingly. After several seizures of the turbine wheel shaft bearing had been rectified the best run, using a 7½ in. torque bar, was at 48,000 r.p.m. turbine speed, 4,800 r.p.m. main shaft, estimated torque 0.073 lb./ft., horsepower 0.066 h.p. (1/15th). The water pump was independently checked at the same speed as it had been running and found to be delivering 2.05 oz./min. The steam rate came out therefore at 112.5 lb./h.p./hr., a not unpromising figure.

In order to see if the turbine would do better at higher speed the 7½ in. torque bar was changed for a 6 in. one. It never did, for in the very first run all the teeth were stripped from the pinion and one tooth of the gear wheel damaged.

My supply of clock pinions now being exhausted the next best thing was a little 22-tooth brass gear which seemed to mesh fairly well with the large 120-tooth wheel after it had been dressed up a bit to remove the damage. At the same time the turbine main shaft was increased in diameter from $\frac{1}{16}$ in. to 3/32 in. silver-steel hardened, tempered, lapped and polished to see if it would cut down the number of seizures and, oddly enough, excessive wear that were occurring at one and the same time.

A further bench test showed that although the turbine was now running more slowly, due to the higher gear ratio, the power output was not greatly reduced. A typical result, still with a single nozzle, was 23,600 r.p.m. turbine speed, 5,760 r.p.m. main shaft speed which, with a 6 in. torque bar, equalled about 0.05 h.p. (1/20th).

*Continued from page 58, "M.E.," January 11, 1951.

Installation in the Hull

All further bench testing was now suspended in favour of getting the plant installed and working in its hull, for I had made ■ secret resolve that if at all possible it should make its first public appearance at the "M.E." Exhibition and the Grand Regatta that year (1949), then about ■ month ahead.

In order to promote the free circulation which had been found so beneficial in the bench tests, the boiler casing is only partly sunk within the hull, as shown in Fig. 18, the deckline being continued with ■ thin aluminium sheet only 6 thou. thick. Although the clearance is only ½ in. it seems to achieve its object as the very thin metal, which can be melted with ■

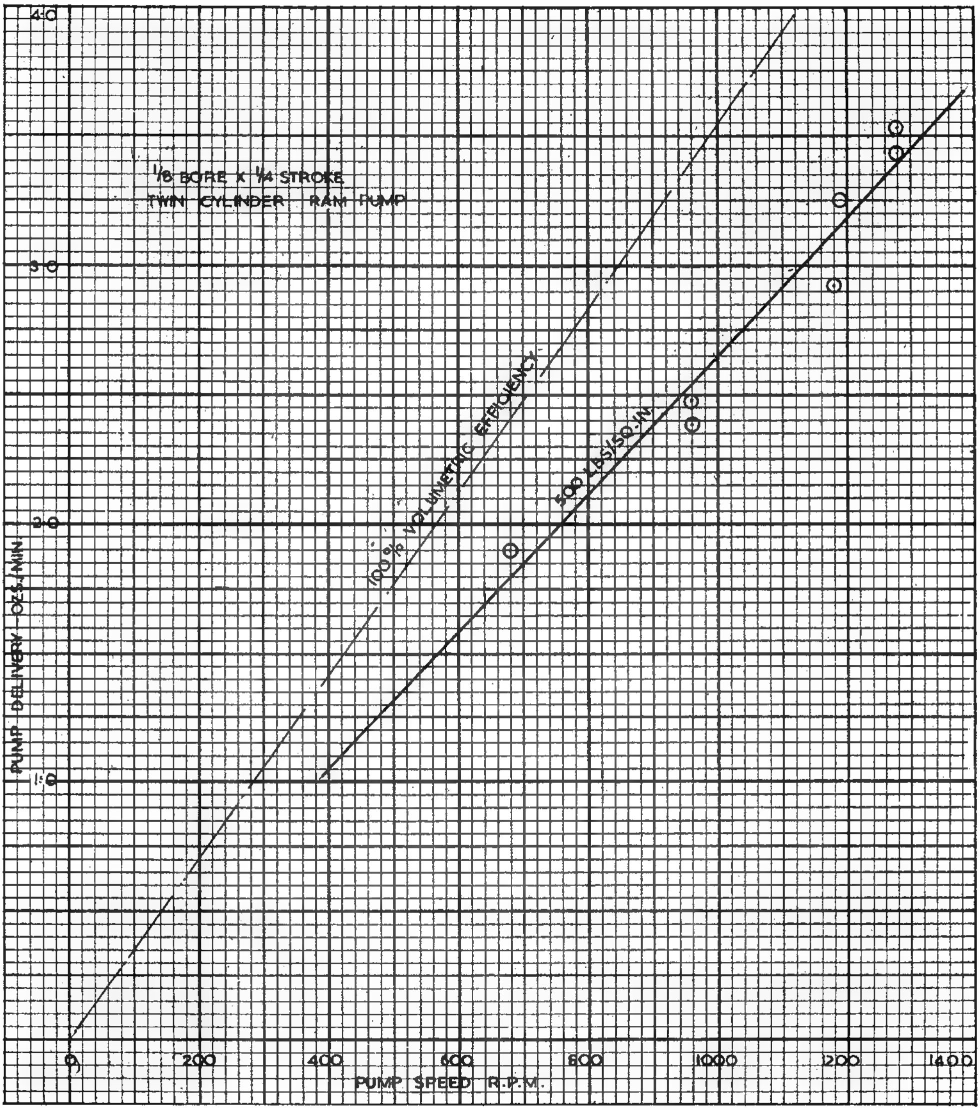


Fig. 14. Test results on a twin-cylinder reciprocating pump

The final result is shown in the photograph, Fig. 17. The hull and running gear are exactly according to Mr. Westbury's description although, as I could not obtain thinner than $\frac{1}{16}$-in. mahogany face three-ply to cover it, it is rather heavy, 1 lb. 5 oz.

match has never been overheated nor, except due to the lamp flooding, has the hull been damaged.

The reduced transom height, 1 in. instead of 1½ in., however, calls for care in handling if flooding of the hull is to be avoided.

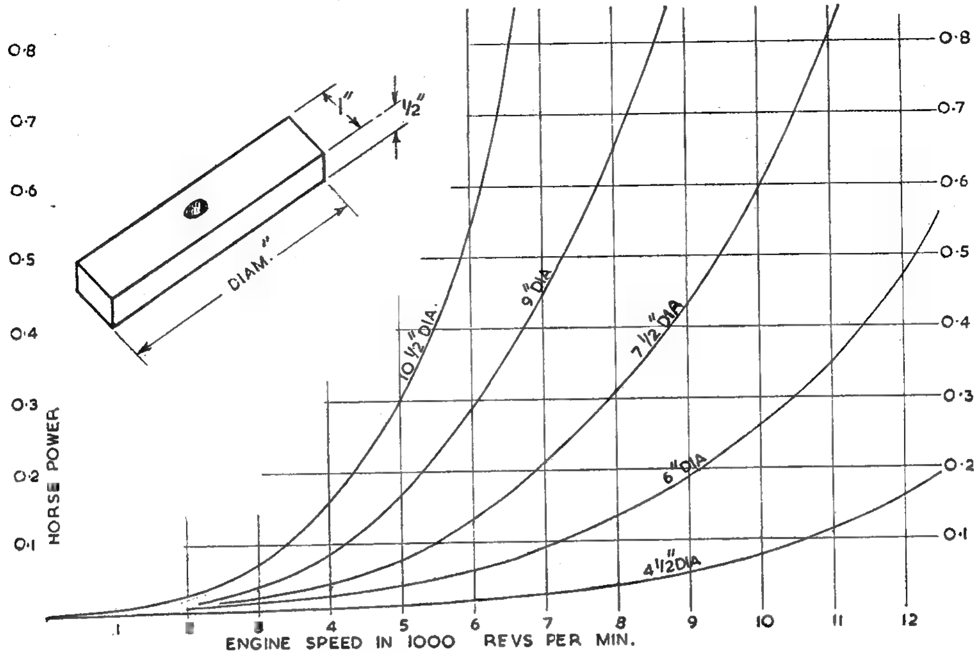


Fig. 15. *Curves plotted from data given in "Aeromodeller," March,* 1949

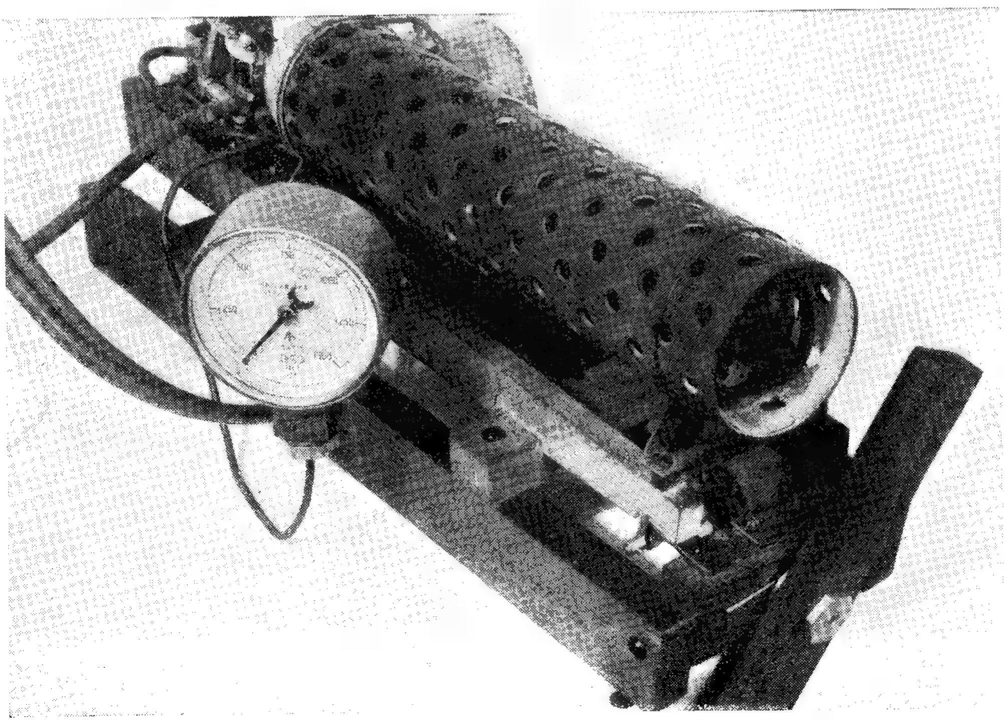


Fig. 16. *The plant installed on a special test bench, showing the "Aeromodeller" fan brake, revolution counter and test pressure gauge*

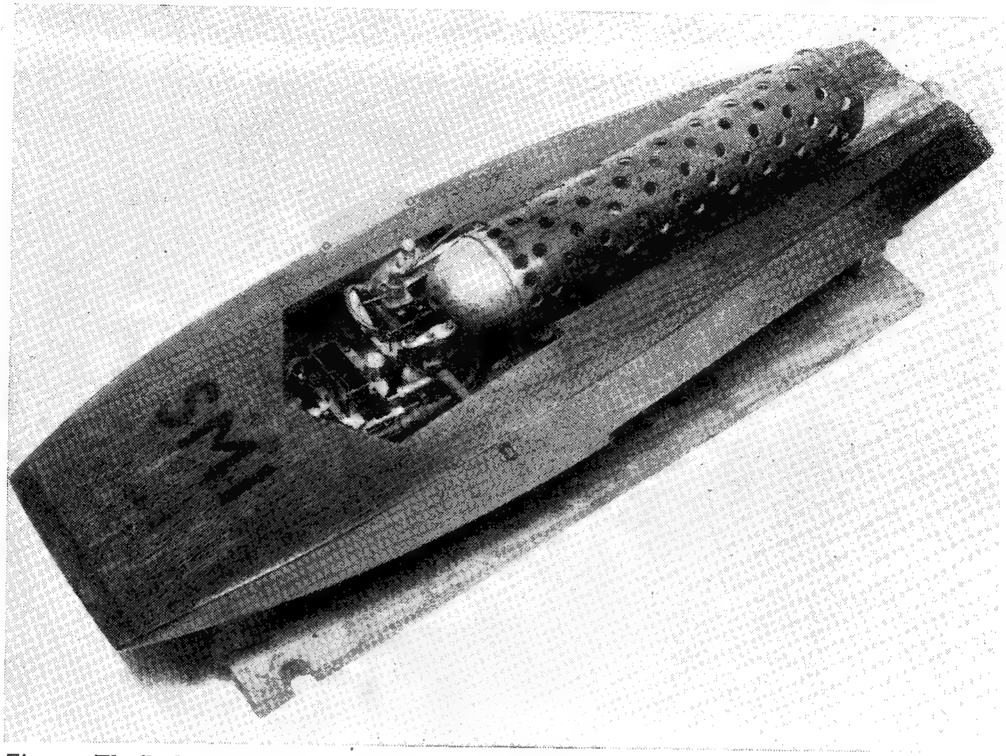


Fig. 17. The flash steam turbine hydroplane, 24 in. long. Total weight 3 lb. The registration letters are of the first and only boat registered by the M.P.B.A. of the S.M.E.E.

Plumbers' Joy

The most significant modifications that were made were to the feed pump system before installation in the boat. I realised that with the conventional flash steam, reciprocating engine geared pump set up, the needs of the engine when accelerating up to full speed were automatically met by the pumps doing likewise. An impulse steam turbine on the other hand uses the same amount of steam regardless of the speed

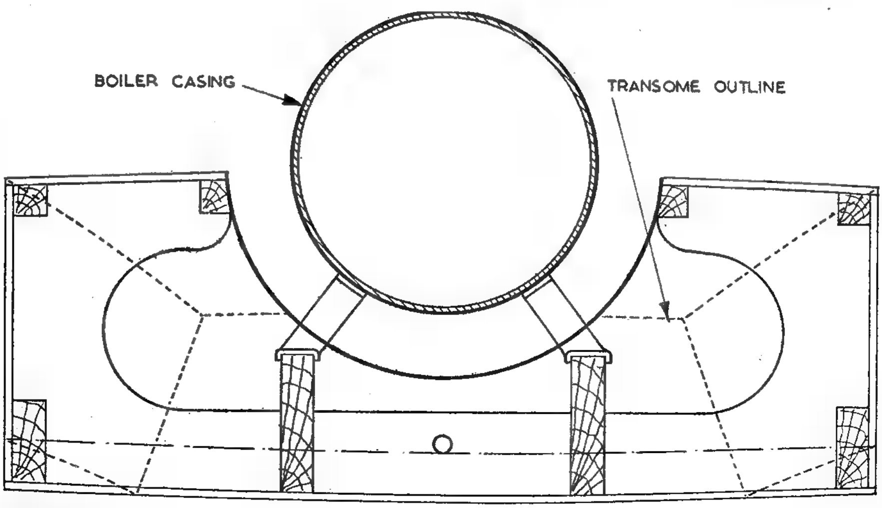


Fig. 18. Midship section of the hull at the step, looking aft, showing installation of the flash boiler and casing

at which it is running. In fact, to develop its maximum starting torque the full flow of steam must be provided; but how could this be done before the pumps had started?

I decided on a compromise, to run the pumps sufficiently fast to deliver the full weight of feed-water at a moderately low speed, and to spill the surplus overboard through a spring-loaded relief valve at higher speeds, relying on the fact that the nozzles, if correctly proportioned, would not take more steam than the boiler could supply, thus making the plant, in a sense, self-regulating. This set-up is shown in Figs. 12 and 13 already referred to, and oddly enough, it is one of those gadgets that really does work like that. I found it necessary, however, to put a further check valve between the relief valve and the boiler as otherwise when the former lifted, the contents of the latter were blown out along with the surplus feedwater, resulting in violent surging.

(To be continued)

He Found Success

(Contributed)

THE paragraph in "Smoke Rings" in the November 9th issue on "The Ladder of Success" reminds me of my early days.

Just over forty years ago I was an errand boy employed by a firm of wholesale confectioners. I had no ambition in life. So long as I had a few pence to buy a few sweets and some books (now called "penny dreadfuls"), I was contented.

Three days a week I had to go out with my employer to the villages in a horse and trap, in order to get orders from the shops. Whilst my employer was in the shops I had to sit in the trap, and I used to spend the time reading my "penny dreadfuls."

One day, I was sitting quietly reading when a voice said "Why don't you read something that will benefit you in the years to come, instead of that trash?" I looked round and saw a middle-aged man, rather shabbily dressed, looking at me. He then walked away and soon returned with a book which he handed to me, saying, "Read this," and walked away again. It turned out to be a copy of THE MODEL ENGINEER. I read every word. I cancelled the "penny dreadfuls" and ordered THE MODEL ENGINEER. I used to day-dream of the workshop I would have and the models I would make when I could afford it.

I started to look for a better job, so to have more money to spend. I found this eventually, at a chemical works, but the money was not much more, so in my spare time I helped a motor cycle and cycle engineer, earning not only some extra money, but also gaining knowledge.

He taught me how a motor-cycle engine worked and also how to time the valves and ignition. I also learnt to use a small lathe which he had. I began to buy tools and the "M.E." series of handbooks.

Then I started on my first model. Material, including a long bronze bush out of an engine, some bronze washers, a single-ended crankshaft, a small hand wheel, some flat iron, and a connecting-rod from an old sewing machine was obtained at "scrap" price, from local garages and engineers. From this material I was able to make my first model engine. When completed, it was tested on a friend's boiler and, after squirting water from every joint, it ran well and I was satisfied. I decided at this point that I must have a lathe to make another model, and I therefore set about to make one.

The headstock was a cycle bottom bracket, cast in a lead block, also the tailstock, which comprised of two nuts and a long pointed bolt. The bed was made of angle iron. The base was an old sewing machine stand, with the treadle and wheel. Lead was cast around the rim of the wheel to increase the weight.

Some time after I had finished this, I saw an advertisement for an improver in a village garage. I was told that I could not be an improver as I had not served an apprenticeship. However, the proprietor decided to give me a month's trial to see if I could be of use to him, but after a fortnight he decided that he was satisfied with my work and took me on a permanent basis.

I found that he had a $3\frac{1}{2}$-in. Drummond lathe and I soon got to work on this. I managed to obtain permission to use this in my dinner hour and so started another model.

Then came World War No. 1 and I joined the Royal Engineers as a motor fitter. I was eventually posted to the Light Railway Section and sent to a repair depot in Belgium, where I was given the job of repairing petrol and petrol-electric locomotives.

After a spell in hospital, I was sent to a base repair depot. This proved to be a complete engineering works, including a foundry.

Whilst sitting one evening reading THE MODEL ENGINEER, two soldiers stopped to ask me if I was interested in model making. They were considering building a horizontal petrol engine and, as I was in the Petrol Engine Section, would I look over some sketches and advise them. I decided to join them and we built an engine, making every part, except for the sparking-plug and timing gears, which were sent to us from England.

When I was demobbed I returned to the garage, and out of my gratuity and savings, I bought a small lathe and stationary petrol engine. From these I built up a small workshop and once more began my model work.

I wanted to get into an engineering works, and managed to obtain an interview with the managing director, taking with me an article I had made in my workshop. I was engaged as a fitter, and have been there now for thirty years.

For several years now I have been maintenance engineer.

I now have a workshop which is equipped in such a manner that there is no job in model making I would not tackle.—C.H.T.

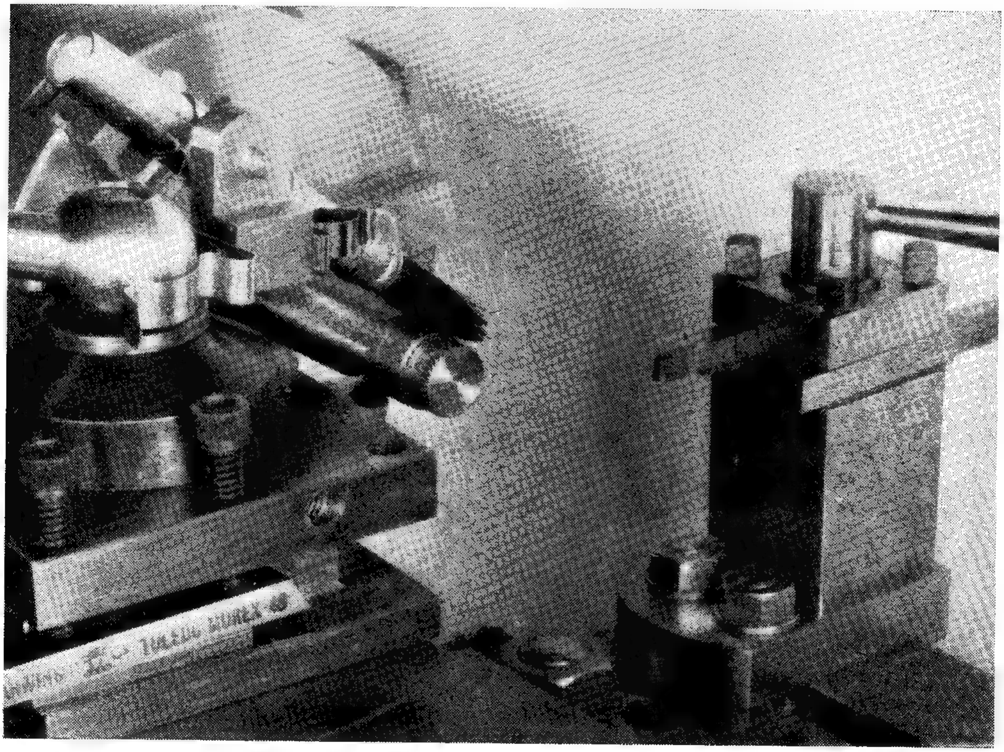
Novices' Corner

Lubricating the Work

A VISITOR to [redacted] large machine shop will at once notice that [redacted] copious supply of cutting fluid is fed under pressure to steel parts being machined in the lathes and milling machines.

The fluid used is forced along the supply pipe by means of a small pump driven from the machine, and is directed by a nozzle to impinge on, or close to, the actual point of contact of the tool with the work ; thence, the fluid drips into [redacted] tray [redacted] that it can run into a sump, where it is filtered and again made ready for circulation by the pump. The fluid used for this purpose commonly consists of [redacted] mixture of water, oil, and soda. The water serves [redacted] a coolant to prevent heat distortion of the work and to keep the cutting edge of the tool from being overheated and blunted. The oil content acts as a lubricant for the tool and enables [redacted] better finish to be given to the work, as well as reducing the amount of power required for the machining operation. Soda is added to the solution to prevent corrosion of both the work and the parts of the machine.

As the cutting fluid is delivered under pressure and in [redacted] steady stream, it also serves to wash away the chips and swarf from the cutting area and, in this way, clogging of the teeth of milling cutters is prevented, and the flutes of twist drills are cleared of cuttings. A supply of cutting fluid is essential for ordinary tools where rapidity of machining is aimed at and the effective life of the cutting tools has to be prolonged in order to save time wasted in resharpening.



The brush holder attached to the tool turret

In the small workshop, on the other hand, it is not always desirable to use [redacted] cutting fluid on this scale, on account of the mess made of the machine and, possibly, of the clothing and the workshop itself. The amateur worker is, therefore, usually content with rather less than the maximum output, and is more concerned with producing [redacted] good finish on steel parts turned in the lathe. For the latter purpose, some form of cutting oil is generally used, such [redacted] lard oil or one of the proprietary oils, of which Cutmax is an excellent example.

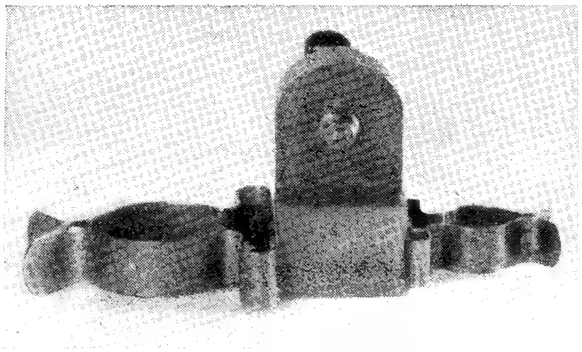
Some workers feed the oil by means of [redacted] drip

can, attached to the lathe saddle so that it keeps in step with the tool; the oil delivery is then controlled by a tap or screw-down valve.

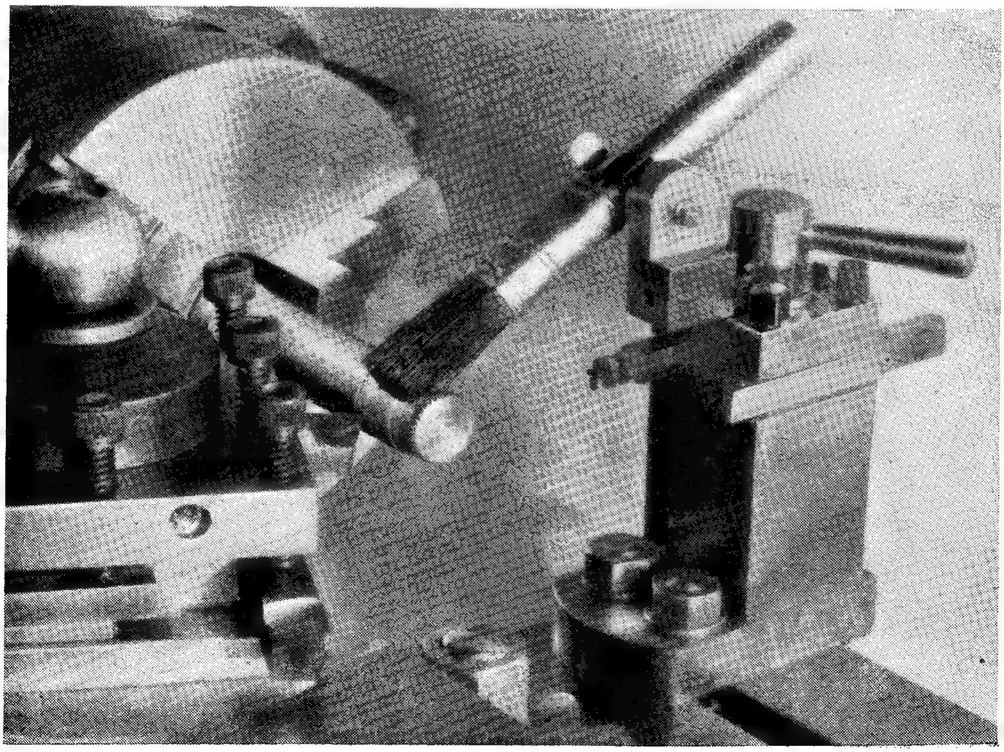
This method of supply, however, has some disadvantages, for, if the drip is intermittent, the work may alternately be flooded and starved of oil, and if the flow is continuous, the surplus oil will collect about the lathe and in the tray where it is not easily recovered. Moreover, cutting oils are expensive, and any surplus of oil thus wasted serves no good purpose.

All that is required, when taking light or finishing cuts, is to maintain a film of oil on the work, as is delivered when a brush dipped in the oil is held in contact with the work; in fact, it is the usual practice in one lathe factory, when machining leadscrews, for the operator to supply the cutting oil by hand with a brush.

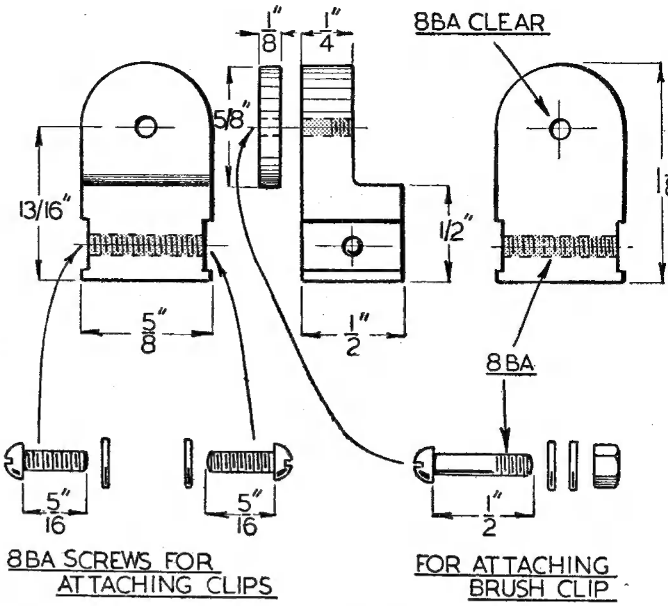
However, to apply oil in this way for taking cuts of long duration is a somewhat tedious business, and to overcome this difficulty a brush holder has been made up which has proved very efficient. As will be seen in the photographs, the brush is held in a rotating spring clip, and spring clips are also used to attach the holder either to the ordinary tool turret or to the back toolpost. When clipped to the back toolpost, the attachment gives better access to the work, as for example when applying the micrometer, for the brush can be turned to stand vertically and is then well out of the way; furthermore, the run of the work tends to straighten the brush hairs, and not to separate them, as is liable to happen if the turret mounting position is adopted. In the illustration the brush is shown mounted at the front of the back toolpost, but even better access to the work will be gained if the holder is clipped to the back of the clamp-nut. This is easily arranged by merely reversing the positions of the spring clips,



Showing the position of the two attachment clips



The holder mounted on the back toolpost



merely reversing the positions of the spring clips, and it is partly for this reason that 8-B.A. screws are specified, for they allow the smallest size of clip used to be mounted in either position. A further advantage of mounting the brush at the back is that, owing to the increased range of movement, the brush can then more readily be adjusted to supply a film of oil to the end-face of the work during facing operations. Although the brush itself can be instantly detached and replenished by dipping it in the oil pot, a fresh supply of oil is, perhaps, most easily given by using a second brush to convey the oil to the bristles.

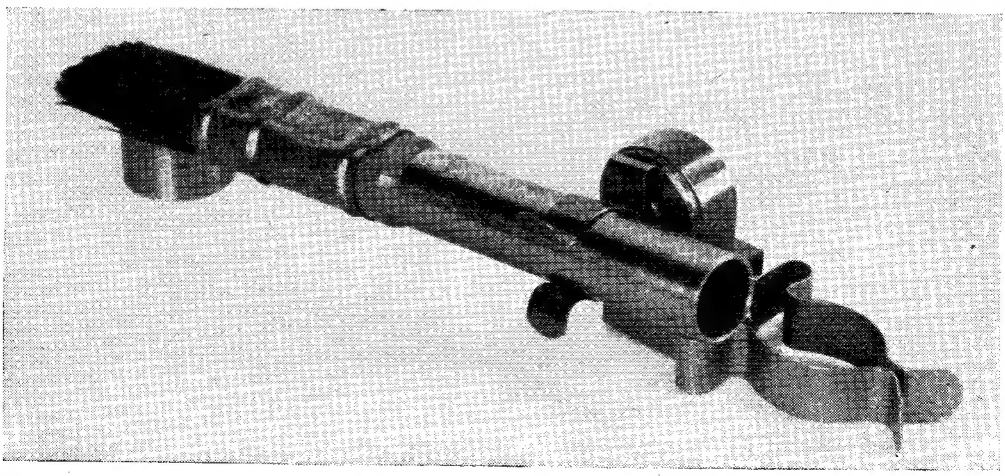
Making the Brush Holder

The body portion of the attachment is cut out with hacksaw and file from a length of brass or mild-steel.

Although the dimensions given are suitable for a turret and a back toolpost in actual use, it will be as well to check these measurements to make sure that the brush, when attached to the back toolpost, will rotate so that it can be set to stand vertically well clear of the work. It will be seen that the base of the body is slotted to afford a mounting for the two attachment clips, and so secure them against turning.

These slots need be no more than 10 thousandths of an inch deep, and can be formed either by filing or by using an end-mill in the lathe. The arched base of the spring clip holding the brush will ensure that there is enough frictional contact to keep the brush in any set position, and it is only necessary to adjust and lock the pivot screw accordingly; for this purpose, the body is threaded 8-B.A., for part of its thickness and a lock-nut is fitted to the pivot screw.

For the brush itself, an ordinary stiff paint brush is used, and one $\frac{1}{2}$ in. in width will be found a convenient size. The handle is cut short and then filed down evenly on all sides to fit into a length of brass tubing having an outside diameter of $\frac{3}{8}$ in. or so. The tube should be left long enough to allow the brush bristles to reach to the centre-line of the work when the cross-slide is set to turn material of large diameter.



Method of mounting the brush

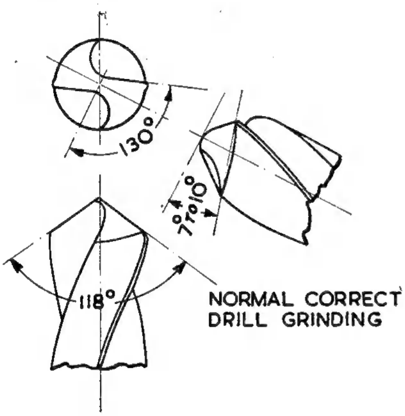
The spring clips fitted are manufactured by Messrs. Terry, of Redditch, and are intended for holding tools in racks. Ironmongers and tool-merchants usually keep a stock of these clips, and the size of the three clips will depend on the actual dimensions of the parts they have to grip.

PRACTICAL LETTERS

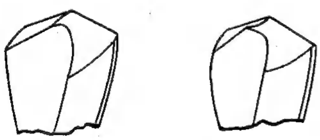
Grinding Twist Drills

DEAR SIR,—The article by Mr. Keith Campbell on this subject in the issue for November 16th, 1950, raises one or two interesting points.

Of the five elements to be held correct in a truly-ground drill, namely: (1) Correct point angle, (2) Equal angle both lips, (3) Equal lip lengths, (4) Equal clearance relief, (5) Relief to give a bridge point at correct angle to lands (end view), only the first two are safeguarded by the jig—pardon, the appliance—described.



NORMAL CORRECT DRILL GRINDING



NORMAL SUSPECTED EFFECT OF CONSTANT ANGLE RELIEF

It is the method of getting relief that intrigues me. Relief is obtained by advancing the drill at the point angle while rotating it. Now, drill grinding fixtures and machines do not give relief in that way; they rock the drill round an axis crossing the drill axis, in a conical sweep.

A fixture such as that illustrated on page 730 of the issue for November 9th, does that. It results in a diminishing point angle as the relief progresses round the drill, the position of the apex of these angles remaining fixed, i.e. they have an apex common to them all. Mr. Campbell's method of giving relief keeps the point angle constant, but brings the apex of the angles progressively down the drill axis.

I wonder what the effect may be at the bridge point. Diminishing angle relief gives a bridge point that is a straight line in end view and crested in side view, the line being at 130 deg. to the cutting edges in end view, when correctly ground. Would not constant angle relief result in a straight line bridge a point that is hollowed in side view? Such a point would not readily centre itself.

Yours faithfully,
Bristol. W. D. ARNOT.

Electrical Testing

DEAR SIR,—With reference to the reply to a query on this subject in the issue of THE MODEL ENGINEER dated November 23rd, I trust you will forgive my intrusion but "G.W.T." is quite in order in his request, and the use of special resistances is not necessary.

I take it that he is familiar with a "drop" test, if so, all he will require is a good quality moving-coil volt or ammeter from which all resistances or shunts are removed, the actual coil of the movement only being connected to its terminals. "G.W.T." may find his readings on some jobs too high. To correct this, connect some copper or resistance wire across the meter terminals adjusting its length and gauge, or take in more commutator bars on his battery leads. If his readings are too low, adjust vice versa. This test is often confused with a resistance test, but as its name implies (drop of potential) it is really a voltage test, and all that is required is a good quality moving-coil meter, which is used as a millivoltmeter, and a three-cell torch, the lamp being in circuit to prevent running the battery down.

During the war years, my contracting business was "axed" and I was directed to a war factory and returned to my first love—armature winding. One day I was given an excellent switchboard type D.C. ammeter, which I adapted, and enjoyed many amusing incidents when the outside electricians came into the winding shop.

There, before their unbelieving eyes, they would see, say, a 50 h.p. d.c. armature being tested with current from a three-cell torch and an ammeter solemnly reading 80 amps.!

Yours faithfully,
Cardiff. W. J. VICKERY.

A $\frac{3}{4}$-in. Scale Traction Engine

DEAR SIR,—I found Commander J. B. Mitford's article, which appeared in your issue for November 30th, unusually interesting.

In 1936, H.M. Submarine *Seawolf* was ordered by the Admiralty to be equipped with an important piece of apparatus (which I had initiated) and subsequently to carry out the sea trials of the apparatus. This necessitated frequent visits to the submarine, and the subsequent carrying out of the trials at sea. It was during one of my visits to the vessel that I saw a model traction engine in the submarine's tiny wardroom, and which I thought might be the property of the engineer officer.

I may add that previous to 1914 I had been a representative of the firm of Fowell & Co., builders of the Fowell traction engine. I was, therefore, well acquainted with traction engines. This was, however, the first occasion during 22 years' experience of submarines (which had embraced nearly every submarine built during the 1914-18 war, and the intervening period) that I had seen a specimen of model engineering on board one of H.M. submarines.

Taking rather more than ordinary interest in the model I discovered, to my astonishment, that it was the work of the submarine's commander—Lt.-Comdr. J. B. Mitford, R.N.

I can still remember the feeling of relief that passed through me to know that the Commander was interested in technical matters ; this seemed a good augury for the forthcoming trials.

The exacting sea trials of new naval equipment seldom go according to plan ; there are invariably teething troubles and unforeseen difficulties of one kind or another. I should like to pay tribute to the patience and understanding with which all my difficulties were met, as I feel that, in this particular instance, the Commander's interest in model engineering ensured that happy co-operation, which was a feature of the trials, and resulted in the adoption of the apparatus by the Admiralty for all new submarine construction.

Yours faithfully,
W. F. THAIN, A.M.I.Mech.E.
Late Principal Scientific Officer,
H.M.S. *Vernon*,
Portsmouth.
Lee-on-the-Solent.

Repair Problems

DEAR SIR,—It has been my experience when repairing broken parts of washing machines, vacuum cleaners, etc., very similar in nature to that so ably described by "Base Circle," that many of the parts, which are usually subjected to considerable stress, are purposely made of material which will not readily braze, or even solder, together.

These parts are often light, and usually possess the virtue of being rustless, but apart from this, have the disadvantage of being next to impossible to repair, the whole idea, to my mind, being that the customer has to re-order a new part.

I found this to be the case when repairing a small "OO" gauge electric locomotive of pre-war vintage, and had to resort to the use of tiny rivets, which did make a good job.

On another occasion, in attempting a repair of a pram wheel, which had all become loose at the hub, it was found that here again the material would not braze.

The difficulty was got over on this occasion by turning a complete new hub in mild-steel, and brazing to the spoke flanges.

Examination of the fractured surface of the breakages invariably shows it to be of a crystalline nature, sometimes bright and shiny, suggestive of a brittleness which is no doubt present, at other times rather dull, reminding one of the state of lead piping gone "sugary."

Yours faithfully,
Glasgow, S.4. R. JOHNSTON.

Asbestos Wicks

DEAR SIR,—Several contributors recently have emphasised the superiority of asbestos wicks for spirit-burning boilers, and I would like to point out a very convenient source of this useful material.

The "line-cord" or "resistance-lead" used on a.c./d.c. radios, to reduce the mains voltage, consists of a cotton covering containing two or three conductors, one of which is a fine resistance wire wound on a stout asbestos cord, which, when cut into convenient lengths, is thus prevented fraying, and is easily handled. I have used it with considerable improvement on other wicks.

Yours faithfully,
Sutton. S. J. HOGBEN.

Gearcutting

DEAR SIR,—I am gratified to see that my article on "Gearcutting" (September 14th) has aroused a certain amount of interest, and I would like to thank both Mr. Horsfall and Mr. Sherwood for their kind remarks.

I would also like to express my sincere appreciation of Mr. Sherwood's brief but very lucid explanation of the point that seems to have aroused misgivings in the minds of Mr. Horsfall and also Mr. Pearman. My own reply to Mr. Pearman (November 2nd) is, of course, on the same lines as Mr. Sherwood's, but I fear mine is much more long-winded.

Yours faithfully,
"BASE CIRCLE."

Toolpost Design

DEAR SIR,—Occasionally in your pages are described methods of height adjustment for forged lathe tools. I have never used these kinds of tools, as I find high-speed bits in an "Armstrong" type holder. I made my own holder out of an old spanner, about $\frac{5}{8}$-in. Whit., I think it was. The point with this type of tool holder is if the square bore is cut at the angle of maximum top rake, the bits can be used until the back end cannot any more be gripped by the screws, as only side rake and front clearance have to be ground on them.

The standard type of four-way toolpost is not of much use to modellers, as they are primarily production tools. I made one to my own specification with a different face on each side. My toolholder is mounted on one face by means of three studs projecting from the post in a horizontal line. Three holes in the holder mate up with the studs, and the middle stud carries the

retaining-nut. Another face carries a normal slot with four locking screws. This is large enough to take a $\frac{1}{2}$ in. square-ended boring bar.

Those who make their own form tools can cut the slots at such a height as to enable the tools to be mounted without any question of packing.

I normally use $\frac{1}{4}$-in. square section bits in my holder and $\frac{3}{16}$-in. square section bits in my boring bar, the latter usually made from silver-steel owing to H.S. usually being far too long for the early stages of boring deep holes.

I have given no dimensions of the components mentioned because they are not universally applicable, and in individual cases may be determined by material available as well as by the lathe for which they are made.

Mine is an M.L.7 and I will gladly give further data to anyone who wants it for that size of machine.

Yours faithfully,

East Ham. A. E. CLAUSON

CLUB ANNOUNCEMENTS

Aylesbury and District Society of Model Engineers

The December meeting of the society, held at Hampden Buildings, Temple Square, was devoted mainly to a showing of films on a projection unit built by Mr. H. East. The films were varied from silent shots taken by Mr. East in 1936, to a sound-colour film on the making of plastics and plastic materials.

The evening was very entertaining and showed the quality of Mr. East's workmanship in making the unit and giving a faultless performance.

Hon. Secretary: E. H. SMITH, Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

The Oldham Society of Model Engineers

The snow and frost which attended the later part of 1950 held up progress at the car track and boating pond. These require further work to be put in before we can consider them complete. However, when weather permits, we can run both cars and boats for our own satisfaction, though at this stage we wouldn't like to invite visitors. Roll on, Summer!

Meetings for 1951 are as follows:—

Friday, January 26th. W. Ogden speaks of his efforts to solve steering problems.

Friday, February 9th. H. Townson speaks on "Building a Gas Engine."

Friday, February 23rd. T. Tasker speaks on "A New 'OO' Gauge Layout."

All above meetings at Room No. 3, King Street Co-operative Education Department, at 8 p.m. All visitors welcome.

Hon. Secretary: F. MILLER, 25, Eric Street, Oldham.

The Junior Institution of Engineers

Friday, January 19th, at 6.30 p.m., 39, Victoria Street, S.W.1. Informal meeting. Paper: "Some Notes on Diesel Locomotives for Mines," by A. O. Ellison. (Member.)

Friday, January 26th. Annual dance at Caxton Hall, Westminster, S.W.1. Time 7 p.m. for 7.30 p.m.

Sheffield and District Section. Friday, January 26th, at 7.30 p.m., Grand Hotel, Sheffield. Ordinary meeting. Paper: "The Erection of a Spirally Guided Gas Holder," by R. A. Benson. (Associate Member.)

North-Western Section Saturday, January 27th, at 2.30 p.m. Manchester Geographical Society, 16, St. Mary's Parsonage, Manchester. Ordinary meeting Paper: "A Marine Engineer's First Voyage," by W. H. G. Powell. (Associate Member.)

Friday, February 2nd, at 6.30 p.m., 39, Victoria Street, S.W.1. Film evening: "Wonder Rock," to be introduced by H. Wallace.

North-Western Section. Monday, February 5th, at 7 p.m., Manchester Geographical Society, 16, St. Mary's Parsonage, Manchester. Ordinary meeting. Paper: "Ramble Through Patent Fields," by A. C. Ashton, M.B.E., B.Eng., F.C.I.P.A. (Member.)

Midland Section. Wednesday, February 7th, at 7 p.m., James Watt Memorial Institute, Great Charles Street, Birmingham. Chairman's Address by H. A. Wainwright, B.Eng., M.Met., M.I.Mech.E., M.I.E.E., F.I.M. (Member.)

Friday, February 9th, at 6.30 p.m., 39, Victoria Street, S.W.1. Ordinary meeting. Paper: "The Hydrodynamics of Ship Design," by H. Volpich, B.Sc., A.M.I.N.A., M.I.E.S., illustrated by films.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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